SOCIO-ECONOMIC AND ENVIRONMENTAL CONTEXT OF FUELWOOD USE IN RURAL COMMUNITIES: ISSUES AND GUIDELINES FOR COMMUNITY FUELWOOD PROGRAMS

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THE SOCIO-ECONOMIC AND ENVIRONMENTAL CONTEXT OF FUELWOOD USE IN RURAL COMMUNITIES OF DEVELOPING COUNTRIES: ISSUES AND GUIDELINES FOR COMMUNITY FUELWOOD PROGRAMS

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The views expressed in this report represent those of the Contractor and are not necessarily those of the U.S. Agency for International Development.

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WEIGHTS AND MEASURES: ABBREVIATIONS

WEIGHTS AND MEASURES

1 Kilometer (Km.)	=	0.621 miles
1 meter (m.)	=	1.094 yards
	=	3.280 feet
	=	39.370 inches
1 cubic meter (m^3)	=	35.314 cubic feet
	=	1,000 liters
	=	220.46 imperial gallons
1 Kilogram (Kg.)	=	2.2046 pounds
1 metric ton	=	1,000 Kilograms
	=	1.102 short ton
	=	0.984 long ton
	=	2,204.6 pounds
1 hectare (ha)	=	2.47 acres

ABBREVIATIONS

APROFON	-	Aprovechamientos Forestales de Nayarit (Mexico)
CARE	-	Concerned Americans for Relief Everywhere
CFI	-	Commonwealth Forestry Institute
CIDA	-	Canadian International Development Agency
FAO	-	Food and Agriculture Organization of the United Nations
FIO	-	Forest Industries Organization
FWDA	-	State Forest Development Agency
IDERENA	-	National Institute for Natural Renewable Resources and the Environment (Colombia)
IDRC	-	International Development Research Centre
km	-	Kilometer
LS	-	Sudanese pounds (monetary)
MIT	-	Massachusetts Institute of Technology
PA	-	Peasant Association
SFC	-	State Forest Corporation
SIDA	-	Swedish International Development Agency
Spp.	-	Species
SUNY	-	State University of New York
UCSB	-	University of California at Santa Barbara
UNEP	-	United Nations Environmental Program
UNESCO	-	United National Educational and Scientific Organization
U.S.	-	United States
USAID	-	United States Agency for International Development
VFA	-	Village Forestry Association

ABOUT THIS REPORT

This report describes and analyzes socio-economic aspects of fuelwood use in rural communities in developing countries. It considers technical aspects only in a peripheral way. The information comes from a review of the relevant ethnographic, topical and project-related literature, and from interviews with knowledgeable persons.

This report is intended for those who are designing or implementing community fuelwood programs; it can be used by both practitioners and researchers to obtain:

- o information about the socio-economic context of community fuelwood use;
- o guidance in resolving key issues encountered in community fuelwood programs.

A brief Executive Summary provides an overview of the report.

The report covers access, production, harvest, collection, transportation, distribution and consumption of firewood and charcoal in rural communities and in community fuelwood programs. Many site-specific details are included; conclusions based on the empirical review are summarized for each aspect of fuelwood use and for community fuelwood programs.

For those identifying, designing, implementing and evaluating community fuelwood projects, six key issues are identified and broken into numerous related issues.

Guidelines point out the information and analysis needed to resolve each issue. There is a complete set of guidelines for each issue. Thus, once an issue is identified as relevant in a particular situation, practitioners may use these guidelines for help in determining the information and analysis required to resolve it.

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EXECUTIVE SUMMARY

Firewood and charcoal have been mankind's principal source of heat, light and energy for centuries; 1.5 billion of the world's rural people and urban poor still depend on this source. This heavy dependence on fuelwood will continue for the foreseeable future.

Fuelwood scarcity has a devastating impact, and its detrimental effects have become increasingly evident in the developing world. It may cause shifts in basic crops, to those requiring less cooking; eliminate important customs such as cremation of dead relatives; reduce the agricultural potential of land because of erosion; and in some cases, require one or more family members to gather firewood on a full time basis.

This scarcity is primarily focussed in rural areas where shortages originate. Community fuelwood programs offer effective solutions in such situations because they are location-specific, can involve the people most directly affected, and can draw upon other local resources to deal with fuelwood shortages.

Community fuelwood programs should take into account the socio-economic organization and the environmental constraints and potentials of each community; usually little attention is paid to these critical village level aspects. This report provides information on both socio-economic and environmental aspects of fuelwood use and community programs.

Firewood and Charcoal

Fuelwood is defined to include firewood and charcoal. Firewood is the predominant energy source for rural people, while charcoal is the usual energy source for many urban people. Rural households and small scale rural industries consume most of the world's fuelwood; in many countries these users depend almost entirely on fuelwood for all their energy requirements. Urban households and industries vary more widely in their dependence on fuelwood, averaging 40 to 50 percent, but reaching much higher levels in some cases.

Until recently, firewood has been a free good in most places; people simply gathered it near their house or village, and distributed it among households according to customarily accepted ways, which included a few instances of barter. But now firewood is becoming scarce in many places. As difficulties of finding firewood increase, old ways of

collection are modified. Men become much more involved in gathering firewood, paid wood collectors become more common, and increasing commercialization means that many rural people must pay for at least some of their fuel. This leaves people who are socially and economically marginal--the old, handicapped, or unmarried mothers--at a serious disadvantage. They cannot find firewood nor can they afford to buy it. Although people may realize that firewood supplies are limited, many are poor and "must live from something," so out of necessity they continue to cut trees. Efforts to eliminate such practices pit the government (or the rich) against the poor.

Charcoal, produced mostly by rural people, is seldom consumed by them. It is a commercialized, urban fuel that draws upon a rural resource base. Specialists produce it mostly from hardwood trees and often at long distances from the towns where it is sold, using production methods that are usually very inefficient. Better technologies exist but they require too much capital for the average, small charcoal producer. Because transport costs for firewood are prohibitively high over all but the shortest distances, rural charcoal producers continue to supply their markets with an inefficiently-produced product.

Charcoal is usually sold, so that only those with sufficient cash income can use it. Consequently, it is the usual fuel of the small businessman and of relatively prosperous urban families. Charcoal is preferred to firewood for many reasons, varying from practical ones, such as its greater heat intensity and lack of smoke, to subjective ones, such as its being regarded as more prestigious than firewood.

When scarcity emerges, charcoal production for urban dwellers competes directly for limited rural firewood supplies. A few rural charcoal producers (sometimes including women) benefit from the employment and profits of producing charcoal in the short term, but many rural people "pay" for the charcoal consumption of urban dwellers in the long run through spending more time or money in securing their own firewood supplies.

Alternative energy sources usually cost more (kerosene) or strain long-established economic and ecological systems (crop residues, dung). As fuelwood grows scarce, both households and small businesses tend to go down the "energy ladder," using less fuelwood or using other biomass fuels rather than consuming expensive fossil fuel. The implications of fuelwood scarcity for quality of life, and also for growth of small scale industries, are obvious.

Community Fuelwood Programs

Concerted cooperative action is necessary to solve local fuelwood problems--and such action needs a "community," a group of people with established values, shared familial and ritual relationships, and similar perceptions of their society and their environment. Stable communities do exist in the developing world, but many people live in atomized and highly stratified situations where community identity is much diminished. Community fuelwood programs established in the latter context are like a house built without a foundation.

Community fuelwood programs are not simply "community woodlots." Most successful community fuelwood programs are multi-purpose, designed for soil-erosion control, fruit production and other purposes as well as for wood output.

The fuelwood aspect of nearly all community programs is heavily supply oriented. Conservation and development of alternative energy supplies have seldom been an integral part of these programs, although they should be included. What is needed is a combined approach, with agro-foresters working with other specialists (economists, social scientists) and also with the local people. Such a combination is more likely to produce an effective integrated program.

Community fuelwood programs are seldom initiated by villagers, but by governments or international donors. Management of the programs often remains in the hands of government officials who, for example, may control the harvesting of wood by the villagers. Such top-down projects may be successful, but only if the needs of the community are met by the project and if community members are involved in planning and implementation.

Community fuelwood programs draw heavily upon outside technical and financial support--extension services, supply of tree seedlings and disease control materials, for example. Such services may help both in overcoming technical problems and in establishing regular cooperation between local people, and also between local people and outside officials. Eventually the community should be able to assume more support roles as in Senegal, where community nurseries provide seedlings and are managed by women, or in Nepal, where villagers become their own extension agents.

A successful program requires the active participation of all local people--or at least of enough of them to provide adequate support. Labor and other inputs of the villagers are also critical; the project may not be economical if laborers are all paid by the government. Active participation depends upon the villagers having, right from the beginning, a clear understanding of the goals, benefits and costs of the program. How

will the wood be distributed? To whom? Under what conditions? How will consumption levels be affected? These are crucial aspects, but they have received little attention in many programs.

Estimation of the benefits and costs of allocating land, and other resources, to community fuelwood programs requires an assessment of many factors--economic costs and returns, value of self-sufficiency, environmental aspects, local perceptions, aesthetically enhanced surroundings and ceremonial sites. A serious and systematic consideration of these factors will make the programs more likely to succeed.

Women

Women (very often with the assistance of their children) are mainly responsible for provision of household fuelwood in most developing countries. Although sex roles are slowly changing, women often walk up to 15 kilometers away from home to collect enough firewood to meet the cooking and heating needs of their households. They also control its allocation and use. Some women, particularly older ones, gather firewood for sale. Although rarely involved actively in charcoal production, women may participate in urban sales of charcoal.

Community fuelwood programs neglect the role of women in fuelwood activities; most programs have been aimed primarily at men, not the main participants in wood collection, distribution and consumption. Women can and should play a central role in the planning, design and implementation of a community fuelwood program. A primary objective of most programs is to increase accessible fuelwood supplies and thereby lighten the arduous burden of women collectors. In addition, women in most areas have an impressive ecological knowledge of local forestry matters such as growing patterns, burning qualities, and medical applications of local species. This knowledge can be used in developing and implementing programs.

Issues

Six basic issues confront those working with community fuelwood programs. Each program should be considered in the light of all six and of the numerous related issues discussed in the report.

What are the Goals?

1. Single or multiple goals? Usually, programs will seek the latter, including increased fuelwood production, agro-forestry, environmental protection, employment, local control of energy resources. Some goals may conflict with others.

2. What goals can realistically be achieved given the specific social and ecological circumstances?

What Type of Program?

1. The program should be oriented toward local needs and must meet some or all of them.

2. The exact design (community woodlot, agro-forestry, integrated rural development program) will be determined in part by the particular location.

3. All community needs and the local environment must be taken into account.

How can Wide Local Participation be Encouraged?

1. Community fuelwood programs have different costs and benefits for various groups within the community, but program success depends on participation of nearly all groups. Otherwise trees of one person are destroyed by animals of another; wood tended for years by one is cut for use by another.

2. The project designers need to have a good basic knowledge of the community, so that they can identify the impact of the project on different groups--landless laborers; part and full-time farmers; traders; children; women, especially widows; elderly; handicapped, paid wood collectors.

3. The needs of each group--as perceived by the members themselves, by other local people and by the planners--should be assessed and accounted for by the program. Differential access to fuelwood resources and differential participation in gathering, production, distribution and consumption activities must be considered.

4. Programs should include both immediate and long term incentives, to encourage and to maintain participation by the "target" group. Education about the benefits and necessity of participation is also important.

What Resources are Required?

1. What land, labor, managerial skills, etc, can the community offer and what proportion of project needs should it provide?

2. When the community cannot provide essential resources the gap must be closed by outside sources. Government agencies must therefore be prepared to help.

What Management Requirements?

1. Community fuelwood programs are complicated and require more managerial and social inputs per unit output than do other types of fuelwood programs.

2. Appropriate management structures and procedures, ranging from democratic participation to autocratic, are critical to project success. Among these are: controlling access to fuelwood resources, arranging technical support systems, developing institutional capacity, creating appropriate incentives, determining the role of women within the program (including its management structure), and developing economic and distributional policies.

What Benefits and Costs?

1. People will stop their participation in a program when they believe their costs are greater than their benefits or that they suffer disproportionately high costs or low benefits relative to others. While their perceptions may not be factual, villagers will act on them nonetheless. Benefits and costs, then, must be considered as perceived by villagers as well as from an outside viewpoint. Whether benefits offset costs in either the short or long run will depend upon each situation.

2. In considering costs, the costs of not having any program should be considered, including:

   a. accelerating environmental degradation;

   b. deteriorating quality of life;

   c. social unrest, migration.

3. Alternative programs should be carefully weighed.

Guidelines

All community fuelwood programs need to take into account three general guidelines, in addition to the many specific guidelines included in the report:

1. The importance of local participation cannot be over-emphasized; this should affect all aspects of planning, implementation, and evaluation.

2. Each program should be considered in relation to the specific socio-economic and ecological characteristics of the proposed location.

This should include not only the specific community, but also wider aspects of neighboring communities, regional links, and proximity to urban centers.

3. There should be a constant and critical consideration of alternative plans and approaches.

I. INTRODUCTION

A. Purpose

The purpose of this study is threefold, namely to:

- o provide a description and analysis of the socio-economic and environmental context of fuelwood (firewood and charcoal) use in rural communities in developing countries;
- o identify critical issues involved in fuelwood use in rural communities; and
- o suggest guidelines that should be considered by USAID in selecting, designing and implementing community fuelwood projects in developing countries.

B. Procedure

The procedure used in carrying out this study included six steps as listed below.*

1. Search and analyze relevant literature sources, especially appropriate ethnographic and related works.

2. Discuss fuelwood use patterns in rural communities in developing countries with knowledgeable individuals in the U.S. and Europe.

3. Describe access, harvest, distribution and consumption of firewood and charcoal in rural communities in developing countries and changes in each as a result of fuelwood shortages.

4. Describe programs that communities have developed to resolve their need for adequate fuelwood supplies.

5. Identify key socio-economic and environmental issues associated with community level firewood and charcoal use.

6. Develop guidelines to be considered by USAID in selecting, designing and implementing community fuelwood projects in developing countries.

*Additional notes on the research methodology are included in Annex 5.

C. Background

1. Firewood

Firewood has been mankind's source of heat, light and warmth for centuries. As a consequence, deforestation has occurred to a greater or lesser degree in many places where men have gathered in groups, then villages, then towns and cities. Lately, however, the consequences of population growth, agricultural production, industrial raw material requirements and other forces of modernization have led to an acceleration of firewood scarcity problems in many (although not all) rural areas of developing countries where firewood is the important energy source.

This scarcity of firewood has had a profound impact on many, going so deep as to affect community social structure, religious activities, nutrition and the customary provision of wood as a girl's dowry. The economic impact of scarce firewood in terms of the increased time and energy required to fetch it and environmental degradation is also severe. For many the economic impact comes down to having to buy what was previously collected as a free good, even when they cannot afford it.

2. Charcoal

Charcoal is another vital source of renewable energy for people in developing countries. It still provides urban people, and especially the urban poor, with a large part of their energy needs today, just as it has for hundreds of years. Moreover, given past and likely future increases in fossil fuel prices, charcoal is expected to be the source of energy for even more households and industries in developing countries in the future. In that it has already begun to become scarce as a result of shortages of wood for charcoal production in numerous areas, increased demand will further raise charcoal prices and tend to decrease the limited wood supplies now available to many rural communities. The environmental, political and socio-economic costs of such patterns of development have already proven to be severe for numerous rural areas.

3. Dealing with firewood and charcoal scarcity

The heavy dependence of most rural and many urban people in developing countries on fuelwood will continue for the forseeable future. Thus, understanding existing patterns of fuelwood use in all areas and the causes of its increasing or severe scarcity in some locations is of vital and long-term importance to the people directly affected by such scarcity and to those who would reach out to help them.

Fortunately, governments, donors and others are becoming increasingly aware of the problem; many have already accepted the challenge of helping the people impacted by it regain much of their energy self-sufficiency and the benefits attendant to it.

Assisting those most detrimentally impacted by firewood and charcoal shortages and the associated problems (erosion, loss of pasture, etc.) requires a focus on rural areas, and specifically on villages or communities in rural areas. It is at this level that people are most impacted by the shortage. In the village or community it is usually easier for people to understand their problem, to see what they need to do about it and to organize to do it. Here their self-help tendencies are most active and their chance to become self-reliant as a result of their personal and joint efforts to realize their aspirations is good. Also, it is at this level where the location-specific aspects of each situation become clear and where effective solutions commensurate with the expressed needs and goals of the people can be more readily identified and implemented. For these and numerous other reasons, many people have decided that "community" forestry and community fuelwood programs or projects need to be emphasized in seeking to overcome fuelwood shortages and to provide needed energy at the village level.

This paper picks up the above emphasis by examining the socio-economic and environmental context of fuelwood use in small rural communities; the results of the analysis are then used to identify key issues to be resolved when developing a community fuelwood program or project for such a community. Understanding the meaning and nature of community then, is an important first step in examining the prospects for "community" fuelwood programs.

"Community" and "village" are terms that occur frequently in the literature on development, with certain fairly clear connotations. These include:

- a fairly stable small-scale, localized group of people
- sharing basic values and belief
- with a clearly defined set of social institutions
- who are relatively homogeneous and unstratified
- being somewhat isolated from urban centers, and
- having a recognized and effective authority (the "take me to your leader" syndrome).

Given this set of criteria, it is easy to see that many of the rural people who are the primary victims of the fuelwood crisis do not live in viable "communities." It is, as is stressed throughout this report, difficult to generalize, but it should be recognized that there is a wide spectrum of social organization that includes some intact and stable village communities that bear witness to the above stereotype -- at least at first glance -- together with many more people living in situations that are highly atomized and stratified, so that there is little or no sense of a corporate or community identity any longer. It is most important to determine this basic social organization -- or lack of it -- in dealing with community fuelwood programs. Many such programs are predicated on there being a community and on there existing a possibility of cooperative effort for the common good when, in fact, neither may exist to any important degree.*

The terms program and project are used interchangeably in this report except where specifically noted otherwise. Fuelwood is defined as both firewood and charcoal.

Many have said of community forestry and fuelwood programs, "The concept is simple, but carrying it out is not." What follows is intended to help those who seek to carry out community fuelwood programs. It may not make such efforts simple, but, hopefully, it will help make them more surefooted and effective.

*Additional notes on other aspects of community fuelwood efforts are included in Annex 7.

II. FIREWOOD

A. Source, Type and Availability of Firewood

1. Source and type of firewood

Firewood is obtained from wood sources on nearly all lands surrounding rural and most urban communities. The vast majority of wood is gathered from unmanaged forest or savanna lands or from tree stands or clumps of bushes scattered amongst cultivated agricultural fields. (In some cases, as in the arctic regions, driftwood is gathered with great difficulty by Eskimos as their only vegetative source of fuel). Where they exist, government-owned forest and other lands are exploited by rural people in search of firewood to the degree allowed or practicable. In some cases, fuelwood plantations or other type programs have been developed to help meet the firewood needs of rural and/or urban people.

"Exploitable" firewood sources are, practically speaking, within a 15 kilometer radius of the community since most firewood supplies are gathered on foot by each household for its own use. Wood resources farther than 15 km are more than a day's walk away and are not readily accessible to the poor household. It may be gathered, however, and transported by animal to the villages for sale to those who can afford to pay for it.

Clear local preferences for specific firewood species and parts of the tree exist. These preferences are based on the burning qualities, availability, and traditional practices relating to the indigenous species found in a particular region. In general the most desirable firewood species are those which are hard, dry rapidly, burn strongly but without getting out of control, provide a "hot" fire, emit little smoke, and give no unpleasant taste to the food (or give a traditional desirable flavoring to the food).[1] Regional and cultural firewood preferences, however, differ greatly.

2. Adequacy of firewood supplies

The availability of firewood is rapidly diminishing due to population growth, shifting cultivation, expansion of agricultural lands, overgrazing of livestock, drought, commercial and domestic over-exploitation of forest resources without attention to future needs, etc. In some cases, as for the Aymara Indians of Bolivia, firewood availability has always been a problem:

> On the raw, cold altiplano fuels loom important. The one or two varieties of trees that grow in sheltered places on the Titicaca plateau are too precious, however, to use as fuel, being employed only to build posts of houses and various objects of material culture. Fuel, in fact, all over the altiplano--as well as by modern Bolivians as by the Indians--is used only for cooking, penuriously.[2]

When speaking of the global wood, adequate wood resources do exist. Nevertheless,

> "even though most developing countries still have sufficient forested lands that their total annual wood production, or natural growth, considerably exceeds the total wood fuel needs of their people,[3] local shortages can be severe."

Such shortages are becoming more numerous and widespread in all regions of the world as areas with large firewood supplies and those with great firewood demands grow farther and farther apart. Many rural communities (and urban areas) have heavily exploited firewood resources in the surrounding areas over time, usually with little thought to renewing them in adequate quantities to meet ever increasing demands for firewood. As everyone knows, and as Knowland states:

> "Trees and forests are essentially capital stocks that produce an annual return of wood. Once a community begins to exceed the regrowth capacity of its local tree resources, or begins to live off of tree capital rather than tree income, a rapid and exponentially accelerating cycle of depletion begins."[4]

As a result of such depletion, firewood collection trips which used to take one to two hours now require a full day in many rural communities. Preferred species are being depleted and so must be substituted with less desirable wood types, or even with other energy sources altogether.[5] The problem of supply for rural communities is further exacerbated by the rising urban demands for firewood which thus forces rural communities into the monetary economy. Supplies formerly available to rural people are carted off to urban areas where the price is higher, leaving the rural poor

without any means of obtaining much of the remaining resources.[6] Or, if the limited supplies remain in the rural area, the urban community and especially the urban poor suffer.

3. Availability and price of alternative fuels

The alternative fuels to firewood available to rural communities are primarily other local materials such as dung, grass or crop residues. Charcoal is sometimes available, but costs money so is used only when necessary or when people can afford it. Other energy options potentially available to rural communities but not widely used as yet include solar energy, biogas, kerosene, and electricity. These alternative energy sources all require cash, both to secure them and to buy the equipment to use them--cash that rural people do not have. Table 1 gives a rough indication of the relative costs of traditional and non-traditional fuels, using Upper Volta as an example. Charcoal is the least expensive fuel per kw and electricity the most expensive one. Firewood costs more per kw than charcoal, but does not require additional investment in a stove. Also, firewood is still a free good in many rural areas if any opportunity cost of the labor used to obtain it is not considered. Likewise, wood for charcoal production is still "free" in many rural locations in developing countries, making it an attractive alternative to firewood. Many can produce it for themselves. Others in rural areas who buy charcoal find its supplies more dependable than supplies of other fuels. Few, if any, of the other non-traditional fuels, are attractive to rural families nor are technological innovations possible in many rural areas at present because of the very low income levels of the people. As Eckholm wrote,

> Nothing, for example, would be better than a dirt-cheap device for cooking dinner in the evening with solar energy collected earlier in the day. But actually developing such a stove and introducing it to hundreds of millions of the world's most tradition-based and penniless families is another story. While some solar cookers are already available, the costs of a family unit, at about thirty-five to fifty dollars, is prohibitive for many, since, in the absence of suitable credit arrangements, the entire amount must be available at once.[7]

Table 1 : Costs for selected sources of energy (urban Upper Volta)

A. Cost of the basic requirements for the various sources of energy

	Equipment Required	Cost (U.S.$)
Fuelwood	some stones	0.00
Charcoal	stove	0.80 - 4.00
Kerosene	stove	10.00 - 14.00
Butane gas	stove & bottle	approximately 52.00
Electricity	stove & deposit	approximately 120.00

B. Comparative KWh costs for the various sources of energy

	Calorific Value kcal/kg	Energy Value KWh/kg	Thermal Efficiency %	Price /Unit (U.S.¢)	Price kw (U.S.¢)
Fuelwood	4,500	5.23	8	3.1	7.2
Charcoal	7,800	9.06	28	9.8	3.8
Kerosene	12,000	13.95	50	30.0	4.4
Butane gas	12,500	14.5	60	68.6	7.9
Electricity	800 cal.	1 kWh	70	10.4	14.8

Source: W.M. Floor, "The Energy Sector of the Sahelian Countries." Policy Planning Section, Ministry of Foreign Affairs, the Netherlands, April, 1977, cited in Arnold, "Forestry for Rural Communities," p. 15.

Biogas plants may provide a viable option for larger and wealthier farm households, but no alternative sources of energy, whether locally producible or distributed commercially, are likely to have a short-term substitution impact on fuelwood use in rural households of developing countries. They are more of an option, however, for rural cottage industries which can more easily afford the equipment investments required.

The use of kerosene and other petroleum products are also virtually out of reach of the rural household, except as a lighting source, particularly due to rising oil prices. Kerosene use declined by 24 percent in Malawi between 1973 and 1976, allegedly due to higher prices.[8]

While the short-term availability and potential of alternative energy forms may look dim, it must be noted that many developing countries have indigenous energy resources not being fully utilized at present, including hydro-electric, coal, oil and gas, geothermal, solar and others. The development of these resources and of distribution systems for the energy they provide will require massive investment and a good deal of time, two factors that discourage their use. On the other hand, increasing fuelwood resources through tree planting also takes time. Many nations may find simultaneous investment in fuelwood and in other alternative energy systems which can deliver product over a similar time period increasingly attractive.

B. Access To Fuelwood Producing Lands

Most rural communities traditionally have had relatively easy access to firewood; today, few communities still possess this privilege. Past and present access to firewood and how it is changing are considered below.

1. Governmental control of access

a. Central government

Former colonial administrations in developing nations exerted a profound, though often conflicting, influence on access to forest lands. On the one hand, they opened up new territories for economic development, leading, for example, to the plundering of the great forests in Burma and Malaya. Colonialism also led to

the establishment and growth of urban centers and mining enclaves, which increased demand for fuelwood. The introduction of European methods and standards of home construction and heating increased the annual cutting of pine, oak, and other trees in the Patzcuaro Basin of Michuocan, Mexico so much that excessive deforestation in the general area was noted as early as the second half of the nineteenth century.[9]

On the other hand, colonial administrations introduced the first widespread conservation measures aimed at protecting the threatened forests and backed by sanctions that were rigorously enforced. The destruction of trees for charcoal in Penang, Malaysia, was prohibited by government decree in 1879, and bans on the use of other woods valuable for tin-smelting had preceded this measure.[10]

Many of these colonial regulations remain the core of central Government edicts in present-day land use authority. Most of the nations of East Africa, for example, retain the practice of governmental demarcation of crown-lands, areas on which legislation regulates cultivation, grazing, and tree cutting practices in order to combat deforestation and erosion. Colonial administration often endowed traditional rulers with new powers to regulate forest land use, as in Somalia, where the sultan received the authority to forbid the cutting of trees for certain periods of time.[11]

Governmental regulation of access varies. At one extreme, no one is allowed to collect any form of fuelwood; at the other end of the spectrum certain species of trees are specifically reserved. It is common to find provisions for the collection of dead or fallen wood. The Wasambaa of Tanzania are allowed to enter the Government Forest Reserve to collect fallen trees and branches, though there is an explicit prohibition against cutting live trees.[12] Mexican land legislation allows the cutting and gathering of shrubs and dead wood, but permission must be obtained from forestry department officials before cutting a live tree.[13] Near Bhopal, in the Indian state of Madhya Pradesh, the Forest Department has granted the people the right to collect headloads of dead wood from forest reserves.[14]

Several countries that have experienced serious deforestation and fuelwood shortages have mandated conservation and reforestation practices by forest land holders that have the effect of controlling access. Owners of forest land in Ecuador are obliged by law to afforest and to maintain the forest stock. The preferred method

for compliance is for the land owner to surrender his forest areas to community ownership and maintenance. If the owner elects to retain control of the forest lands, he must either carry out conservation and reforestation at his own expense or have the Ministry of Development pay for such work in exchange for the donation of 70 percent of wood production to the Forest Service.[15] Landholders in the Republic of Korea must either carry out reforestation themselves or turn over suitable lands to local Village Forestry Association management in exchange for one-tenth of the wood product. Since most of the lands selected for reforestation previously generated no income at all for their owners, they are relieved to turn them over to the VFA's.[16] China pronounced reforestation and conservation as one of the principal goals of the peoples's revolutionary movement, mandating mass participation in tree planting for fuelwood and other wood products supply.[17]

b. Local government

Regulations concerning the exploitation of fuelwood resources also come from the local level. Traditional tribal and community customs and practices have developed over the years with built-in control systems against the destruction of important forest stock. The Sherpas of Khombu, Nepal, formulated restrictions on cutting and land clearing that conserved fuelwood resources for this forest community. Recently, however, these protective codes have been relaxed and violation of cutting restrictions has increased.[18] Arnold reports that a community control system was developed to arrest destructive cutting and build up fuelwood resources, within the framework of local tribal customs and rituals, which remains effective in a region of central India.[19] Many East African peoples used to conserve forest resources by forbidding people to cut on steep hillsides and on the banks of rivers and streams. Sometimes particular species, usually valuable hardwoods, were especially protected. The Chagga and Kikuyu peoples, for example, respected the large mahogany trees, which could be cut only with due ceremony and with permission of the elders.[20]

The increasing shortages of fuelwood and timber caused by land clearing and other industrial exploitation of forest have given rise to at least one new community movement to regulate access to valued wood resources. Angry at the massive destruction of local forests caused by lumbering operations, a group of residents of the Indian state of Uttar Pradesh literally grabbed hold of particularly valued trees to preserve them from cutting. This event gave rise to the Chipko Andolan, or "tree-hugging" movement, which, in the

1970's, grew into a regional movement to protect ecologically vital trees and to bring about greater democratic control over forest exploitation and conservation.[21]

2. Tenure

Land ownership, or tenure, represents another way of regulating access to fuelwood resources. Tenure is not, however, a certain indicator of control of access to fuelwood, as is considered below. Government, communal, and individual ownership forms are considered, and changes in patterns of tenure are examined.

a. Government tenure

The State owns and controls the natural forest areas and those forest plantations established or planted through state decree in China.[22] However, in most developing nations, the central governments possess only a small percentage of the fuelwood producing lands. The state holds only two percent of the total land area in Nigeria and only 19,8 percent of the forest land in the Republic of Korea.[23]

Land ownership does not, however, provide an accurate picture of the control of forest land use. For example, while the government owns a relatively small percentage of the forest land in Korea, government land-use regulations effectively control the exploitation on all privately held land; conversely in Nepal, where the central government technically possesses all forest lands under the provisions for state ownership of all agricultural property, forest and wasteland, exploitation has been left to the control of the panchayats, the local governing units.[24]

Deforestation and fuelwood shortages have led some nations to alter land tenure systems in order to increase central government holdings of forest resources. India has adopted a system of departmental exploitation of forests on a no profit, no loss basis to reduce the exercise of destructive customary land privileges and to ease pressures on forest lands.[25] The Government of Tunisia has appointed a large amount of forest land for the same reason and has implemented strict regulations establishing forest districts and mandating the preservation of their natural state. Allaoui claims this regulation does not improve forest resource management, but does upset the human and ecological balance that has been established

through traditional nomadic movement. The result of these land reform measures has been overpopulation of the forest region near Maghreb with accelerated destruction of its fuelwood resources.[26]

b. Communal tenure

Rural communities in almost all developing nations enjoyed from ancient times certain customary privileges on nearby forest lands. Several types of communal fuelwood land have been reported from Mexico, including cooperatives. In some areas scrub forests unsuitable for farming were set aside as communal fuelwood reserves. The woodlands around Tarascan and Cheran, for example, were declared public lands, with each member of the community given the right to cut firewood on these lands.[27] Collective ownership extends to those forests established or trees planted through the collective efforts of communes, production brigades, and production teams.[28] In Malawi, 93 percent of all land is customary land under the control of village chiefs and headmen.[29]

Customary land law in Kenya is being replaced by statutory provisions; the result is a movement from communal to individual land ownership. This transition has been the most pronounced in the more desirable western and central regions, while more arid, marginal land areas remain predominantly under communal control.[30] Ironically, a direct consequence of gazetting of better forest lands has been the forced movement of poorer cultivators into the dry season grazing lands of pastoralist groups, causing accelerated deforestation and soil erosion on these lower potential lands. Thus, new areas of shortage are created as populations migrate as a result of the Kenyan land tenure reforms.

Fuelwood scarcity, in addition to forcing migration, has also forced modifications in tenure, cultivation and settlement practices. The governmental exploitation of forest tracts in the large islands of Indonesia to increase fuelwood and industrial wood supplies has necessitated the settlement of local shifting cultivators, who for centuries had enjoyed unrestricted movement over and access to forest lands.[31] The opposite effect is seen in Brazil, where a settled population has been forced by declining fuelwood supplies into a nomadic lifestyle. Whole villages have changed their location in the Cantinga area of the northeast, as adjacent forests were stripped of wood. Nomadism has also increased in the more prosperous southeast region, due to a shortage of available fuelwood and the erosion of productive soils.[32]

c. Individual tenure

Where private tenure exists, the owner usually possesses exclusive rights to woody vegetation on his land. Sometimes private tenure will co-exist with collective land tenure, all individuals possessing rights for gathering wood in the common land.[33] Among the Ifugao of the Philippines, "rich men own the forests but anyone may gather dead wood in them."[34] Common lands may be mixed, as in Guatemala, where some wooded slopes are reserved for the owners' exclusive use.[35] When individual titles are granted to land, it usually results in a diminution of others' rights to use the vegetation for any purpose, although bonds of kinship and friendship may lead to a relaxation of such prohibitions.

Many societies (especially in tropical Africa) require that wood be collected from the "bush farms" of the household, or on land over which a descent group such as lineage exercised rights. In Somalia, for example, "The hills with trees for firewood belong to the 'gens' within whose confines they are found: to cut wood on a hill belonging to another 'gens' is considered a theft."[36] Among the Tiv people in Nigeria, however, wood can be gathered anywhere, and the felling of a tree or gathering of branches from a felled tree establishes ownership of that wood.[37] Around Ibadan, Nigeria, all wood except that already prepared for burning can be taken from a neighbor's farm.[38] In India, 35 percent of the people who collect firewood do so on their own land.[39] Individual ownership extends to those trees personally planted around homes in China.[40] In Java in Indonesia, home gardens supply a good share of family fuelwood needs.[41] Forest land use rights are frequently given to the family that retains agricultural use-rights to the surrounding area in many countries.

Bukh notes that among the Ewe of Ghana, where men and women hold separate lands, the men possess the better share, including the bulk of the forest lands. This is because the forest area is used for the production of valuable tree crops, such as cocoa. If a woman has children, her own family will not let her use her lineal usufructory rights to forest lands, because the children can only inherit the father's lands.[42]

On the other hand, the following description of women's usufructory rights to fuelwood in the Tzotzil region of Mexico indicates that they enjoy considerable privileges in gathering activities:

> The chief land-oriented activity of women is wood gathering. Every morning, groups of women equipped with tumpline, bill-hook, and ax set out to bring back wood for the cookfires. In contrast to situations in other hamlets like Navencauk, where women must seek firewood on their own or their husband's land, Apas landowners cannot refuse any women the right to fell their trees for firewood. Once felled, the tree becomes the property of the woman who felled it, and she can return at her leisure to pack its sectioned branches and split trunk into bundles to carry back to store under the eaves of her home. Were another woman to be caught stealing wood from a tree she had not felled, she could be forced to replace the stolen wood.[43]

3. Informal means of regulation of access

Many peoples have sacred groves where cutting is prohibited. The Mbere of Kenya reserve several of the more valuable and scarcer species as the property of the patrilineal exogamous clan. These species cannot be cut without special permission; offenders are punished with the fine of a goat, as well as having to make ritual amends for disturbing the harmony.[44]

A number of forests in Nigeria are associated with shrines, gods, cults, and important ancestors. There also are "reviled forests," where the bodies of unfortunates (such as smallpox victims and people struck by lightning) are placed.[45] Cashew trees are regarded as the homes of ghosts in the Cassamance area of Senegal; the local people will not use their nuts and wood nor settle near cashew stands.[46]

Ritual attitudes toward animals also may affect access to fuelwood sources. The prohibition on eating pork has led to the proliferation of wild pigs in the forests of many Muslim countries, which has resulted in the destruction of young trees and damage to older ones. The sacred ritual of free grazing for cows in India presents problems for the safeguarding of tree seedlings.[47]

Hostility from neighboring groups has been a further factor restricting access, causing some areas to be avoided and some fuelwood expeditions to be made only under armed guard. Among the Ifugao of the Philippines, for example, firewood collection was dangerous when it was near enemy territory, so "men and boys went

in bands, five watching out while the others chopped, taking heavy woods having a high fuel value."[48]

4. Fees pertaining to fuelwood exploitation

The payment of collection fees to the individual, communal, or government owners of forest lands is an increasingly common practice, especially in Central America.[49] In Cheran, Mexico, for example,

> the Federal Government, since 1949, levies a nominal land tax on the community for the forest lands. Each head of a household pays a fee (rustica), usually 25 centavos a quarter, which is collected by a committee on community property (bienes comunales). This sum covers the taxes and gives each person the right to cut firewood from public lands. Persons exploiting other forest resources (lumber, charcoal, posts, etc.) pay more.[50]

Sudan has instituted a tax on each donkey load of wood sold, in an attempt to control Acacia cutting.[51]

5. Discussion

With the notable exceptions of the conservation and reforestation drives in China and the Republic of Korea, most national and local government efforts to regulate access to fuelwood-producing lands, covering the spectrum from simple legislation to police-type patrols, have been ineffective. For a long time this was the result of an attitude that fuelwood would always be available. "Sea Never Dry," as the popular Ghanaian fisherman's saying proclaims, or, "in the words of a contemporary Turkish forester, 'the forest was regarded as one of God's gifts to mankind to which everyone might avail himself.'"[52]

People no longer regard the forests or savanna as an inexhaustible resource. But they are trapped by necessity into a pattern of wasteful actions. In Bara, Sudan, Digernes found that people were keenly aware of the effects of over-exploitation of the land -- overgrazing by sheep and goats; increased cultivation; uncontrolled and extensive cutting of firewood. They noted and

deplored the disappearance of valuable species of grasses and of other vegetation. Yet they had no choice but to continue the very practices that led to such environmental degradation:

> These people knew that the land or the trees belonged to somebody, either to the Government or to villages nearby. They also know that it is illegal to cut any Acacia senegal or other tree, except when clearing for cultivation, without permission from the Forest Office in Bara, and that a tax should be paid on each donkeyload of wood sold.

But,

> Never ever do we ask anyone about any permission. We take trees belonging to other people. We cut them when they are too young. We never pay any tax. Everything is in a mess for us now. We are in a miserable state after our animals starved to death during the drought. We must live from something. What else can we do?[53]

Similarly, when a Mbere (Kenyan) man was asked about the effect of his actions (cutting large trees near a river bank to burn for charcoal), he indicated he knew his actions were environmentally disastrous. But the man turned to his questioner and said, "Who will feed my children if I leave the trees? Will you?"[54]

In cases where governments have eased restrictions to allow limited exploitation of forest reserves to meet growing fuelwood needs, two consequences have invariably resulted: the "limits" are exceeded, and entrepreneurs utilize the access rights to cut large quantities of firewood at concessional rates for sale to nearby urban and semi-urban markets. When the Indian government authorized the collection of headloads of deadwood for personal use from forest reserves in Madhya Pradesh, indications were seen almost immediately that much "dead wood" was being actively manufactured through "ring barking" or by outright axing.[55]

Mexican law requires the granting of permission for any cutting of a live tree, but very little attention is paid locally to this law, as the following observation illustrates:

> Woodcutters who pay a small bribe to the forestry agents chop fallen trees (and standing ones, too) into firewood; they fell oaks that it will take centuries to replace; they strip hillsides and mountains; they take the logs by burro to the highway and load them on trucks so that city people can have charcoal-broiled steaks and decorate their houses.[56]

It is possible that the foresters employed to patrol the woods themselves were responsible for cutting violations, as Beals' remarks on forestry in Cheran in 1949 indicates:

> The source of pay of the forester is obscure, but he is entitled to make use of a certain amount of fallen timber on his own account and if he encounters poachers from other towns . . . he may either confiscate their products and sell them or charge the poachers 20 or 25 centavos for each burro load. The proceeds are kept by the forester.[57]

With such a tradition of official corruption, it is not surprising that local people do not show great sympathy to foresters and assistance groups that urge fuelwood and timber conservation. Louis Gonzalez provides this depressing picture of the local outlook:

> Padre Federico thinks, however, that the loss of trees will bring catastrophe. "It will stop raining; the lowlands will be covered with stony patches, and the fields and hillsides will be nothing but rocks." He fights deforestation; he asked people to scatter pine cones, and he asked the Subsecretariat of Forestry for help. It has all been in vain. The pines refuse to grow, and the forestry inspectors go right on taking their mordidas (bribes) and allowing the trees to be cut.
>
> Most people don't worry about the loss of trees. They don't believe it will cause droughts; they are not saddened by the thought of a bald-headed Larios Mountain; they don't expect to see any increase in the whitish stony patches or any deserts of rocks. Ejido members, and some

> who aren't even that, know they can make enough cutting firewood to cover household expenses.[58]

In some countries, the governing authorities are unable to keep track of tenure, let alone to regulate access to fuelwood resources. The central government land offices in some districts of Kenya, for example, have lost track of land-ownership title-deed transfers; in these areas, where mortgages constitute the sole source of security for purchases, land title changes hands so rapidly that it is not possible to keep up to date on the transfer approvals coming in from the local offices.[59]

At the same time as governmental authority is unable to effectively regulate access to fuelwood resources, most traditional local conservation practices are breaking down under population pressure, growing urban markets, and the desperate demand for this energy source. An integral factor in their decline is that traditional authorities (chiefs, elders, village headmen, priests) can seldom exercise any real power because many of their formal administrative and judicial powers have been taken away by the state; their informal powers, such as supernatural sanctions, are largely discredited by the various forces of modernization. The decay of traditional conservation authority leaves many regions in which the regulation of access primarily depends on individual good will or a sense of obligation toward the larger society; and, as Gonzalez' impressions of Mexico indicate, such a sense of obligation appears to have decayed along with traditional authority:

> If they strip someone else's property, they have the satisfaction of knowing that some "rich guy" is gnashing his teeth; if they cut on their own land, there is more room for corn. In the ejidos (local districts), cleared areas become cornfields--less and less productive and more and more extensive.[60]

Clearly, significant reforms are needed to reconcile long-term needs for the regulation of fuelwood resource exploitation and the more immediate needs of those depending on firewood, especially the poor. The question of how to control access to fuelwood resources stands at the heart of the problem faced by community leaders, forestry department personnel and various other government leaders.

C. Harvest/Collection and Transport

According to Robert Heizer,

> Few ethnographers give firewood collecting and the use of fire more than passing mention in their descriptive accounts, apparently because they feel that such prosaic and mundane activities are unproductive avenues of inquiry and it is difficult to get a clear picture of this matter from ethnographic data.[61]

Yet, a fairly clear picture of firewood collection does emerge from all the ethnographic data and personal experiences available today. It is presented in the section below.

1. Labor

Most firewood is self-collected in rural areas of developing countries. One or more members of a household collect firewood for the use of the entire household, which is often made up of a collective family. In urban areas, where firewood is used, a member of the household may be responsible for harvesting and transporting it. Often, however, urban households buy their firewood from a cutter or agent who harvests the wood in more rural areas near the town or city.

Fuelwood collection used to be a gender-defined task. Within each individual society roles regarding wood collection were strictly demarcated. In the wake of increasing supply shortages, however, sex roles are constantly being adapted to meet changing needs. It can still be said in general that women are responsible for the majority of the wood collection in Africa (except for logs and other heavy cutting where men sometimes assist the women), and conversely that men do much of the collection in Central America. However, it is increasingly commonplace to observe both men and women sharing the collection responsibility, as has been the case in Asia especially, but also in South America for quite some time.[62] Thus, when speaking of fuelwood collection, there are infinite variations in the patterns of collection and continual modifications of existing patterns. The following examples serve to illustrate the diversity of "traditional" modes of wood collection and the gradual adaptation and interchange of formerly distinct roles.

In much of sub-Saharan Africa, where woodfuel is the basic cooking fuel, women are the very visible collectors and transporters of all firewood supplies. The same is true in the Sahelian region:

> Une des caractéristiques des sociétés sahéliennes est la très nette division des tâches entre les sexes. D'une manière générale, l'homme est responsable de l'approvisionnement de la famille en céréales tandis que la femme doit se procurer le bois de chauffe et les condiments nécessaires à la préparation des repas. Celle-ci est du domaine des femmes et l'espace et les ustensiles de cuisine sont pratiquement interdits aux hommes.[63]*

In Tanzania, "Every aspect of fires and fuels is the work of women in Kwemzitu, and no other task is considered to be as tiring or as demanding, or to have so little to show for itself." Women begin helping to collect wood as young girls, almost as soon as they can walk, and continue until they are physically unable to make the trip any longer. There is no regard for age, although the task of old women may be lightened by daughters or daughters-in-law.[64] Among the Tallensi of Northern Ghana, the female responsibility is similar.

> The most exacting task in a woman's routine is the provision of firewood and water. It takes one day to collect for three days....it is an acute strain if she has a young child...a woman goes (to collect firewood) at her husband's bush farm, four or five miles distant. [65]

The Masai of East Africa regarded firewood collection as appropriate only for married women, not for unmarried girls, but elsewhere in Africa, as in Upper Volta, young children, both boys and girls, accompany their mothers.[66] A study of Cruz das Almas, Brazil also showed that women and children gather the day to day supply of fuelwood.[67]

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*Translation: One of the characteristics of Sahelian societies is the very distinct division of tasks between the sexes. In general, the man is responsible for supplying the family with grain while the woman must procure the firewood and the seasonings necessary for the meal preparation. The latter is the women's domain, and the kitchen area and utensils are practically prohibited to men.

Men, although not involved in the actual wood collection activity, may have a significant cooperative role in its procurement. As early as 1939, a study of Bemba, Zambia concluded that:

> "Wood for the fire has to be collected daily, or every two days, and this is women's work. (A man) will cut down a suitable tree for her to pick up. She usually carries a bundle of dried wood six to eight feet long on her head."[68]

In Tanzania, the women provide 90 percent of the wood-gathering labor, but the men undertake 90 percent of the work necessary to maintain the tree crops through cutting and trimming.[69] The Limba of Sierra Leone assume that each sex must do its own work exclusively; women and girls are the sole collectors of fuelwood.[70]

In some parts of the world firewood gathering is done by people of both sexes and of all ages. In the highlands of Peru, for example,

> many people pick up firewood as a normal part of any excursion outside of the village, and it is common to see men, women, and children dragging or carrying small bundles of firewood. This type of gathering is usually insufficient and special trips for collecting firewood are necessary. Women tend to stay closer to the village, while men will range farther in search of the best wood. Such trips occupy roughly 10% of the time spent in subsistence activities since they frequently head for kichwa fuerta to spend several days cutting and hauling wood.[71]

The same is true in Bara, Sudan, where women collect wood if it is near home, but if the supply is more than four km away the collection is done by the men.[72]

Men are not excluded from daily collection activities; on the contrary, in Central America this is overwhelmingly men's work. In Jamaica, "wooding is a boy's work." Maya women of Central America are permitted to gather "fallen wood, in the bush. Such wood is called moloch, which is not regarded as suitable for a man to procure."[73] Among the Iban of Borneo, around the turn of the century, the provision of wood was a major duty of the husband, who was scolded by his mother-in-law if he failed to provide enough firewood.[74] In more recent times, in Mbere (Kenya) men are increasingly having

to collect wood themselves, especially when wives are absent or sick, the household is small, and the men cannot afford to pay for a servant or to buy alternate fuel.[75]

A study conducted in Pura, India found that of the 45,094 human hours spent per year gathering firewood by the community, men contribute 35 percent, women contribute 36 percent and children 30 percent. Men are more likely to fell trees to obtain wood while women and children primarily gather the loose wood supplies. Three-fourths of Pura's families depend totally on gathering of free wood supplies for their firewood, 80 percent of the energy used in Pura. For the rest, nine percent gather wood, supplementing it with supplies from their own sources; 3.6 percent depend entirely on either their own supplies from their private property or only on purchased supplies; and seven percent use a combination of the two. Thus of the 217 tonnes of firewood used annually in Pura, 81 percent is freely gathered, 16 percent is from the private property of the user, and three percent is bought. Yearly consumption per person is about 0.6 tonnes.[76]

Firewood collection is often a social matter, few collectors (particularly women) going alone. Someone returning home from his or her farm may pick up some bits of firewood, but specific excursions to gather wood are rarely made alone. Reasons for this include affinity for company, a fear of enemies or of the bush, or a male anxiety that unaccompanied women will get into mischief. Although women go in groups, they usually collect on an individual basis, and the only cooperation seen is in helping each other lift their heavy loads. In Upper Volta, the women do not share their wood nor the gathering work. Collecting, cutting, bundling, lifting, and transporting is entirely an individual woman's work.[77] In Guatemala, "Women are supposed to gather wood in groups of two or, preferably, more: 'because two women may go for firewood taking a small child with them, and one will hold the child while the other goes off into the bush with another man. It is better if many women go together to get firewood."[78] Similarly, the Nyakyusa women of Tanzania customarily go in groups of 3 to 12 to gather fuelwood, as do the Kwemzitu women of the same country. Members of the groups assist each other in the collection process.[79]

> Most women travel in a group to collect firewood and thus are able to assist one another in splitting the wood, cording it into bundles, and lifting the bundles and balancing them on one another's heads.[80]

In some Nepalese villages a tradition of communal fuelwood and fodder gathering exists. Not only do the women of different villages voluntarily agree to organize the gathering process for a given area, but they also establish a collection rotation system taking into account the need for adequate regeneration and recovery of the forest resources of the region as a result of the firewood harvesting.[81]

Documentation of the collectors' attitudes gives conflicting evaluation of their like/dislike of the activity, and seems to be limited to feelings expressed by women. The Fleurets' study in Tanzania concludes that "It is no wonder that the firewood task is so disliked by Kwemzitu women--it is arduous, taxing, and time-consuming".[82] But Pierson, writing of Brazil, states,

> Many women enjoy this task, 'I like very much to go after firewood,' said a woman in the village. 'If we don't need any at the house, I go with other women. It's a long way and there's a hill so steep you have to rest three or four times climbing it. But if I see someone coming back with firewood and they haven't asked me to go along, I don't like it at all![83]

Of the people of Chiapas, Mexico, Hunt says that the "Women enjoy gathering firewood. Going to gather wood is a very nice break in the routine, and women usually go in the company of other women with whom they chat, exchanging news and gossip".[84]

Elmendorf, as an observer, comments on the satisfaction that the Mayan women said they experienced in collecting firewood:

> I had never really understood why most of the women did not seem to mind going to the woods, the immense loads of firewood they brought back looked painful to carry on their tumplines, their foreheads straining against the rope...A Mayan friend...told me later that when women go to lenas (gather wood) it is an outing--a group experience. 'The women love it,' she said. 'They are free in the woods.' In addition to collecting wood, they gather all the different kinds of flowers, plants, and roots. [85]

Elmendorf said about one of the women, "I asked her son why he did not help his elderly mother carry firewood. 'She likes to lenas,' he said."[86]

Heizer summarizes the attitudes as follows:

> "Ethnographers have characterized the collecting of household firewood as 'a ceaseless search,' 'an odious task,' 'a lowly and endless process,' and 'a distasteful chore.' At times fuel collecting by the women of a village is considered pleasant group social activity."[87]

It is impossible to make universally valid generalizations, and there is always the danger of imposing external perceptions on the collectors. There was probably, at some places and at some periods, limited enjoyment to be gained by the firewood quest, just as rural women derived some pleasure from other routine tasks, but it is unlikely that firewood collection today provides much satisfaction. Nearly all collectors face long journeys, restrictive laws, selfish landlords, dwindling forests and higher prices, and fuelwood is simply one of life's major sources of anxiety for many collectors.

Paid collectors are increasing, although they carry out a very small part of the overall collection of fuelwood, due to the increasingly monetized economy and growing tendencies toward a division of labor. In Cheran, Mexico, rich widows without grown sons pay others to collect. In fact, the whole process of firewood collection is becoming more commercialized, at all stages.

> Both wood and charcoal are more difficult to obtain in Bara, Sudan now than ten years ago. Whereas it used to be one of the daily duties of a Bara woman to go and collect wood, she now considers the supply areas too far away and buys the fuel needed from professional collectors, often newly settled nomads who lost their animals during the last drought and have taken up wood cutting and selling as a new livelihood. Self-collected firewood is used only in very rich households that have servants employed for this, and in families so poor that they absolutely cannot pay for fuel, but have to send children or women to distant places to find the firewood needed.[88]

In Western Nigeria older women (over 35 years) collect and sell firewood, entering the commercial sector on a small scale, but the "younger women find the firewood trade degrading," and so do not endeavor to sell wood.[89]

In general, paid collectors are more common in urban areas. Many rural areas are presently transitional, however, in that some wood is sold to richer people, but most of the people still collect their own fuelwood. Their opportunity cost of doing so is lower than paying for bought wood, a reflection of both relative poverty and relative valuation of time. Families that move from rural to urban areas often begin buying firewood, with men taking over the responsibility from women for providing for domestic energy needs. Women who organized the collection and distribution of firewood in rural areas where it was a free good usually turn these operations over to the male side of the household once currency becomes involved.[90]

2. Species and part of tree collected

People everywhere have a precise evaluation of firewood, knowing which species and parts of trees are the best for specific purposes--for roasting, simmering, brewing, quick heat, a fire to warm oneself, etc. There is extensive technical knowledge among the local collectors and users concerning the species indigenous to the region and their cooking, heating, medicinal and other qualities, passed down from one generation of users to another.

> Man had to find out (many things) about the fuels he adopted--whether they ignited quickly and burnt brightly, or were slow to kindle and gave much smoke; whether they needed careful tending, or could be relied upon to burn steadily and long; and whether the heat they gave was fierce or feeble."[91]

The indigenous criteria in firewood evaluation was examined by Metzger and Williams in their "Study of Native Categories: Tzetal 'Firewood,'" which sets forth clearly the main evaluation criteria for firewood by a group of Maya Indians in Chiapas, Mexico. They include:

"good"	"poor"
-- hard	-- soft
-- burns strongly	-- burns quickly
-- dries rapidly	-- dries slowly
-- its fire is hot	-- its fire is only a little hot

In addition, some kinds of wood are not burnt in the Tzetal household fire

> "because they say that our chickens will die; we will be seized by insanity; our children will get epilepsy; or, we won't have children."[92]

Such local cultural prohibitions of certain wood species are not uncommon, but are often unrecognized by outsiders. For example, in the Cassamance area of Senegal, cashew trees are regarded in that community as the homes of ghosts, so villagers will not use or protect them. A proposed cashew tree planting project near the village would have failed had it been carried out.[93]

In Central America, oak and pine are favored woods, followed by madrone, walnut, cedar and ash. ("Oak burns hot and clear, without smoke; pine is used only for kindling; cedar gives a hot fire but throws off dangerous sparks."[94]) In the Sudan, Acacia senegal is recognized as a superior and valuable tree. Several ethno-botanical accounts describe firewood classification in detail.[95] The Tzoltil of Mexico categorize firewood as "best," "less efficient" and "least efficient firewood," and rate Quercus candicans as their top choice.[96]

In addition to preferred species there are also preferred parts of the tree for use as firewood. A fuelwood use survey of villages in the Republic of Korea found that 47.1 percent of the household energy demand was met by using twigs, and only 11.9 percent was consumed in the form of cut firewood, illustrating the distinct preference for one kind over another.[97]

An Indian study found that 96 percent of wood gatherers take twigs as the main fuel type, and branches and roots (shrub roots) as their secondary types -- 83 percent and 13 percent respectively. Those villagers purchasing firewood bought either branches or roots, and those getting wood from their own property used logs previously made from the felling of trees (71 percent).[98]

Much of this classification of preferred fuelwood has become academic, however, as the firewood shortage has forced people to use up the most valued species and to turn to all sorts of substitutes. As supplies diminish, living tree limbs are cut and even whole trees felled. In areas with extreme wood shortages, complete tree stumps are laboriously uprooted and cut up for fuel.[99]

In India, rural fuelwood requirements are met primarily from gathering in existing forests, but the supply shortage has forced more intensive collection. Brushy growth, field margins, roadsides, canal banks, and wastelands are added sources of firewood, as are isolated trees and homesteads.[100]

In Colombia, old houses are regarded as community property and used for firewood.

> The widespread 'mining' of tree roots indicates the straits to which the people are reduced for firewood supply. Even food trees such as Parkia and Butyrospermum are no longer spared." [101]

And among the Gonds of India, "every remaining non-fruit tree has its boughs lopped year after year to provide fuel."[102] Mangroves, although valuable for building poles, are burnt in Southeast Asia and used for charcoal in the Caribbean, though often forbidden by law.

Firewood shortages, then, have led to (a) a wasteful use of the most valuable trees; as well as (b) the use not only of "merchantable bole (or stem wood) but branch wood, twigs, bark, stumps and nonwoody tissue such as fresh twigs, leaves, and even grasses."[103]

People generally recognize that--as John Webster wrote, 350 years ago, "old wood burns brightest," and will allow their fuelwood to dry out, if this is possible. (An exception to this occurs in South India, where wood is sold by weight, so sellers often soak the firewood in water to increase its weight) In Boulenga, Upper Volta the women are reported to prefer the green wood of living branches because it is easier to collect.[104] It is increasingly difficult to collect only wood which has dried out due to the shortage of supplies. One finds, as a result, the manufacture of dead wood by girding or 'ringbarking' trees in areas where cutting of live wood is prohibited, as in India.[105]

3. Distance, frequency and time requirements of trips

Wood collection begins near the home and gradually increases in distance as nearby sources are exhausted. As shortages grow, gatherers must go farther, more frequently, and look longer in order

to secure sufficient firewood supplies for cooking and heating. Gathering activities can require from several hours to seven days each week depending on the season, environmental conditions, supplies and time constraints of other subsistence activities.

For the Kwemzitu in Tanzania, Fleuret and Fleuret state that women spend 11 hours per week on fuelwood collection, making two or three trips weekly, of two to four hours each. It usually requires over an hour to reach the collection site which "requires a climb of over 150 meters, so steep in some places that steps have been cut into the dirt of the hillside." This wood is usually augmented with supplies (twigs, branches, bark) from the farm and collected by children.[106] A study of the Nyakyusa, also in Tanzania, documented that four to ten hours a week, spread among two or three trips, were spent in fuelwood collection. Often women's gathering activities are combined with tending food crops in daily trips to the cultivated fields, gathering for approximately two hours in late afternoon, as well as on the way to and from the field.[107] In Ghana, Martin estimates an average of four or five trips per week, from two and a half to seven miles, and the Mbere of Kenya varied from one to four trips weekly, averaging two and one half hours each.[108]

The study by Ernst of Boulenga, Upper Volta found that women spend over four and a half hours per day in wood collection, walking about one hour out from the village on a narrow footpath to reach available fuelwood supplies, with at least an hour's walk back carrying the load.[109] In rural Peru, women spend "roughly 10 percent of the time spent in subsistence activities in cutting and hauling wood."[110]

A study in the Philippines included the following observations concerning firewood collection:

> Firewood is scarce in the populated central provinces of the North Luzon Highlands--in East Pasil, adult male members of the household travel to Middle Pasil--one or two hours each way--every day during the dry season, with firewood - gathering as their only objective. They are sometimes refused permission to gather in certain areas because of the growing scarcity in Middle Pasil.... Depending on the size and quality of the wood, one member of each household must spend about five hours every three days in cutting and splitting the wood in addition to time spent in gathering wood.[111]

By contrast people in a neighboring area, where wood is more plentiful, spend about 20 or 30 minutes a day gathering firewood, and also less time in cutting the wood as "there are many more old, mature trees that make better firewood and are easier to cut and split."[112]

FAO figures show that in wood-poor areas of Tanzania and Gambia, fuelwood gathering requires respectively 250-300 and up to 360 person days per household per year, in order to supply the household's fuelwood needs for one year.[113] In some hill villages in Nepal, fuel and fodder collection for one household may require the full-time labor of one person, while, in other areas, women and children must spend an average of 11 person days per month (between 4.7 and 19.9) gathering firewood and 15 days per month for fodder collection because of the increased distances covered to obtain adequate supplies.[114]

In some areas of Niger, villagers go over 25 km (one way) in order to collect sufficient supplies. This is more than a one-day journey, and results in much time for other activities being lost.[115]

4. Weight and volume of loads

Specific examples of weights and measures of the fuelwood loads gathered on daily collection trips are not plentiful. Morgan comments on the difficulties of measuring by volume and concludes that "the whole state of calculation is too inexact for the effort to be worthwhile at present."[116] This is not to say that load weight estimates have not been made--they have been and examples are given here to provide some indication of the numbers. An early description of Kikuyu women (Kenya) stated they walked to the forest from 5:00 to 9:00 a.m., collected loads weighting up to 66 lbs (30 kg) until noon, rested two hours, then walked back from 2:00 p.m. to 7:00 p.m.[117] An interesting question arises here: why did the Kikuyu have to go so far afield seventy years ago? Other case studies have estimated that -- Guatemalan men carry 75 to 100 lbs (34 to 45 kg) of firewood; Upper Volta women average 26-34 kg, with many having loads as low as 15 kg; and Tanzanian women carry 33 kg per load.[118]

The Fleurets' case study of a Tanzanian village estimates that 22.4 kg of wood was needed per day to satisfy the fuel demands, but because fuelwood collection trips were only taken two or three

times a week and wood is stored for the rainy season, each trip must secure more than the daily requirement. "Measurements of the three loads that a Kwemzitu woman brought home from a five hour expedition yielded a total volume of 0.163 cubic meter and a weight of 98.7 kilograms".[119] Thus the average weight per load is about 33 kg. The wood is gathered from a hillside, making several trips up and down the slope in order to collect enough fuel. The preferred woods are long, straight branches and large pieces in order to balance the load and minimize the loss of smaller pieces.

> There are also recognized places on the downward path where women may leave part or all of a load, returning to collect it another day. No one ever disturbs the wood belonging to another women.[120]

5. Means and cost of transport

Human backs and heads undoubtedly carry most of the developing world's fuelwood, at least on its initial journey toward the consumer. Pictures of women bent over in wood transport abound.

In addition to human labor, animals are also used to transport fuelwood supplies between source and end user, particularly for a small commercial operation or for wealthier villagers. Donkeys are used for both collecting wood and for door-to-door selling, as documented in Hausa, Nigeria and Bara, Sudan studies.[121] Horses, as well as donkeys, are reportedly used in Haiti, and mules carry wood in Mexico.

Carts drawn by donkeys or oxen are also used, as are motor vehicles, for the transport of firewood and even more for charcoal, which is of higher value per unit of weight. Motor vehicles are used primarily in moving fuelwood supplies from the rural collection sites to the urban consumption areas. In the Sabo Hausa area of Nigeria, urban supplies are brought from the savanna in the northern part of the country by lorries which take kola nuts, oranges or other commodities to the north, and cannot find loads to bring back, so they carry fuelwood back rather than come back empty.[122] As firewood supplies recede farther and farther from the rural and urban user communities, transport of firewood is gradually being taken over by motor vehicles which are more economical for the added distances.

The collection and transport of fuelwood imposes a burden not only on humans, but also, on occasion, on the land. Branches and trunk are sometimes tied together in a single bundle and dragged down the slope, as in Mexico. "In time this forms narrow ditches which come down the hillsides and are seen near all the towns, like delicate black lines crossing the yellow grass."[123]

6. Technology

Most fuelwood collection is done with some combination of machetes, long knives, axes, and hooks on the ends of poles (to reach and cut up available wood sources). Frequently local fibers are used to tie up the loads for carrying. In Upper Volta, for example, the majority of fuelwood is obtained by cutting, using long knives and local axes.[124] In the Sahel, in general, local axes and sometimes machetes are used to cut wood. These tools limit the wood that can be cut to a diameter of 15-20 cm. Large trees are not used. The lack of saws or well balanced heavy axes limits wood collection to a fraction of the available resources.[125]

The above collection equipment and technologies have been extant for an extended period. When introduced, however, they had major impacts upon fuelwood resources in some areas. The drastic cutting of Australian fuelwood resources that followed the introduction of the steel axe in the bush is an extreme example of the impact of knives and axes in general.[126] Brand, describing fuelwood exploitation in Mexico, suggests that the rate of cutting was accelerated by the introduction of charcoal burning by the Spaniards and by the use of "steel hatchets and axes."[127] Recently, an innovation with similar impact potential has been introduced in some areas (e.g., Kenya, Nigeria), in the form of the chain saw or, as it is called in Nigeria, the motor saw.

7. Seasonality

Fuelwood collection is most often concentrated in the dry season -- the agricultural off season -- because of increased accessibility of the wood source areas and decreased time pressure after crops have been harvested. In Mexico,

> Wood gathering, while a year-round activity, is most intense in the months of spring when the trails are dry and the days long enough for women to make up to three trips a day for wood. In other seasons, rain and slippery

> trails make more than one trip per day unpalatable, and other household activities are given greater attention.[128]

In Brazil, firewood gathering efforts peak in the agricultural off-season, generating self employment for otherwise idle rural labor.[129] In Kwemzitu, Tanzania people collect more wood in the dry season and store the surplus for the rainy season.[130]

In the Upper Volta villages of Boulenga and Ranga, millet stalks are collected for fuel from the harvest-end in November until May. During late April and early May the women begin using wood, which they collect once or twice daily to build stocks for the rainy season. During the rainy season there is little time for collection and dry wood is difficult to find. Household reserves are tapped until the harvest when millet stalks again become abundant.[131]

8. Ecological balance

Firewood harvesting has greatly affected the ecological balance of many rural communities, usually detrimentally.

> One effect of firewood gathering that has been often noted is the denudation of land which may result from tree cutting. Erosion of land surfaces as a result of this activity has been observed in China (1940), in the vicinity of large Indian towns in Central America (1921), in the Teotlalpan district north of the Valley of Mexico (1949), in North Africa (1960), and round African villages in the middle Niger region (1958). Until the full scale development of fossil fuels for industrial purposes, vast areas were deforested for making charcoal for mining and smelting, lime burning, and brick-firing operations.[132]

Similarly, shifting cultivation has substantially impacted upon the environment of many rural areas. In northeast India, an increasing population practicing shifting cultivation has reduced the fertility of soils to such an extent that only four villages of some 100 people each can be sustained per 50 square miles, and, at any one time, only 1/8 of the land can be cultivated.[133] Similarly, in Indonesia, villagers who migrated from Java to the outer islands as part of a governmental resettlement program have found continuous cultivation impossible, either because local

soils are inadequate or the promised technical assistance has not been forthcoming. As a result, many of these people have become shifting cultivators, clearing greater amounts of land of trees and significantly reducing the surrounding indigenous forest and wildlife resources.[134]

9. Discussion

Reports from all over the world stress two main points: first, there is a remarkable variety of harvesting and collection practices, depending in large part on what fuelwood is available to collect; second, as wood scarcity increases, so do the difficulties of collection increase, and so do old customs become modified.

For example, collection used to be assigned to women, or sometimes to men, but this was a socially prescribed task considered appropriate for one sex or the other. Such hard and fast divisions are disappearing under contemporary conditions of stress, which lead to a greater flexibility of division of labor. This change indicates the significance of fuelwood in the daily lives of rural people; the impact of its scarcity is such that it forces changes in social systems that have existed for centuries.

Changes are also evident in the social value and enjoyment of firewood collection. Whereas collection used to be a time of socialization, it is rapidly becoming a difficult and reviled activity for many as firewood scarcity deeply impinges on their daily lives.

Throughout this report, it is noted that there is an observable increase in commercialization of fuelwood activities, which applies to collection. Paid collectors are increasing, even though they collect only a little of the total firewood used. Where this trend is well developed, however, it may provide a basis for a community fuelwood program that must recoup some of its costs from the sale of firewood. It also provides a local standard for the value of firewood that may enable villagers to see the economic merits of their own community fuelwood program.

There is in most places an extensive local technical knowledge of the properties of different trees in relation to cooking and other uses. But scarcity affects availability, and now most people have a greatly restricted choice. As preferred species disappear

they often have to use trees or parts of trees that they know to be inferior as firewood or better used for lumber, etc. They also substitute crop residues, dung, charcoal and other local fuels for firewood (as is noted below in the firewood consumption section). Local fuelwood programs can build upon both this local knowledge of what firewood species work best and the pressures brought about by the people's increasing use of undesirable species and parts of trees and shrubs.

Scattered reports give some idea of the specific details of collection - how many miles do collectors travel? How often do they collect wood? How heavy are the loads? How is the wood carried--by people, animals or vehicles? Is there a seasonality of collection? What tools are used in cutting and collecting firewood? Again, scarcity leads to difficulties. The same general patterns of collection are often followed, but people spend longer, go further afield, return with less wood, inferior quality wood or other sources of fuel such as crop residues. The scarcity of firewood and the increasing labor requirement for its collection impacts in many areas of a rural person's life -- agricultural production, types of food cooked, leisure time availability, ceremonial activities, community ecological balance, etc. Both the details of these impacts and of the firewood and other components of the village or community fuel system are important elements in considering a fuelwood project for the community.

The introduction of the chain saw into some rural firewood and charcoal systems is a potentially devastating innovation. It immeasurably increases the overall potential for rapid deforestation in rural areas. Mere possession of the saw tempts one to take on the "big stuff" and enables it to be done in a hurry, especially where some aspect of wood poaching is involved. It also speeds the commercialization of firewood collection and eliminates a substantial number of jobs, both at the same time.

The fishermen of many developing and industrialized countries (including the U.S. in the case of the Chesapeake Bay and the Columbia River) are constrained from using any but the most primitive fishing equipment in order to protect and preserve the long term potential of the fisheries. Now is the time to introduce such constraints in the case of the chain saw for general use in producing fuelwood in many developing countries to preserve their long-term fuelwood potential.

D. Distribution

1. Means of allocation

a. Household

The basic means of fuelwood distribution is the household, usually the group that eats from a common source. Collected firewood is allocated among household members according to their household responsibilities. Women are the principal users within the household as they are normally responsible for all cooking activities. Infrequent mention is made of firewood being supplied to people who are old, blind, lame, pregnant, or otherwise handicapped or restricted. The literature provides only limited evidence, but it can safely be assumed that the scale of traditional obligations is generally becoming narrower, with more emphasis on helping nuclear family members and less concern for elderly or weak and marginal members of an extended family. The plight of these weaker members of society is dire if there is no one to help them obtain the basic necessities of life such as firewood.

Hoskins claims that women sometimes receive less than their fair share of firewood under traditional methods of distribution. In Niger, for example, while women play a vital support role (cooking meals, etc.) in tree planting activities, the fuelwood harvested is allocated according to which man planted the tree from which it was cut. The woman's share of the benefits from forestry work, therefore, depends on the industry of her husband and on how many wives he has. Widows have no title to fuelwood at all under this system.[135] It is doubtful, however, that the Niger case is representative of a general pattern of sexual inequity in firewood distribution.

b. Sales

Sales of firewood, while accounting for only a small part of all firewood used, are common and increasing. The market obviously depends on supply and demand, but it appears that fuelwood availability is the key factor in determining whether this commodity is free or sold, and where its price is set. Lawless' study of Pasil villages in the Northern Luzon Highlands of the Philippines notes that in the most densely populated section firewood is regularly exchanged for rice, but in West Pasil, where populations are sparse and pine trees abound, there is no market for firewood.[136] The shift of fuelwood from a free good to a widespread, marketable commodity occurred in Mbere, Kenya, around 1976, although a few individuals

(mainly school teachers, rural business owners, and bar and canteen owners) had previously bought fuelwood.[137]

The sellers of firewood at the village level are often (though not always) the poorest people, as firewood selling is usually a low status occupation. The income earned from such sale varies from region to region and often from village to village. Firewood sales sometimes represent the sole source of income for the seller, as is indicated in Digernes' observations of sellers in Bara, Sudan:

> One or two persons per family worked in wood, each selling about seven donkey-loads per week. This gives a cash return of 840 pt per month, seasonal fluctuations in price taken into consideration. This income puts them on the same level as unskilled adult workers in the irrigated gardens of Bara. However, their all-round situation is harder . . . . For some of the families the 840 pt from woodselling is the only input to the family budget, whereas others also have milk from goats that survived the fatal drought.[138]

In some cases, firewood marketing creates employment for the agricultural off-season. Some four million people (or 10 percent of the population) in Andhra Pradesh in India, get off-season employment through the collection, transport and sale of Prosopis juliflora firewood. This caused Reddy to remark "It is doubtful if all the government schemes designed to improve the lot of the poorer sections could give more assured income than what the prolific presence of Prosopis provides to them.[139]

The same person who cuts the wood usually eventually sells it. A large amount of firewood sold in Nigeria for example, is peddled on roads to customers passing in cars.[140] In other cases dealers or their agents either buy in rural areas and sell it in towns, or they hire firewood gangs or timber-cutters who produce a large firewood by-product. These dealers and their agents are sometimes substantial businessmen. Some have reaped windfall profits as a result of firewood shortages. Ox-cart drivers in West Africa, for example, can recoup the initial investment needed for their establishment as fuelwood traders in under three months.

Fuelwood marketing and sale has only recently come under detailed examination by governments of developing nations; what little time series information is available (Table 2) suggests that prices for this commodity have increased, for the most part, at a higher rate than commercial fuel

Table 2 : Firewood Prices for nine countries, 1965 to 1977

Nation	Year	Price ($US, 1978/m3)
Bangladesh		
- retail price in Dacca for Gazari split	1967	18.30
	1977	29.40
Burma		
- retail price in Rangoon	1965	4.30
	1977	9.90
Cameroon		
- retail price in Yaoundé	1971	6.10
	1977	14.50
India		
- wholesale price at CuHack (Orissa)	1969	7.30
	1977	22.90
Indonesia		
- average local market price for natural forest fuelwood	1970	1.30
	1977	3.20
Madagascar		
- retail price in Tanarive	1973	8.60
	1976	14.20
Pakistan		
- retail price in Karachi for Babul fuelwood	1965	16.90
	1976	30.20
Philippines		
- domestic wholesale price	1965	26.50
	1977	46.00
Senegal		
- retail price in Dakar	1974	30.20*
	1977	29.50*

*These figures appear to be inaccurate in light of the previous data, unless some government price regulation (not indicated in the FAO report) is now in effect.

Source: FAO, Forest Product Prices 1960-1977, pp. 11-12.

prices during the last decade and that fuelwood scarcity is a central factor behind this increase in price and the simultaneous rise in sales.

People who buy firewood (mostly urban dwellers) are spending an increasing proportion of their household budgets on this item. Buying enough wood for cooking each day takes up to 30 percent of the income of the poorest classes in Ougadougou (Upper Volta) and 25 percent in Niamey (Niger).[141] People from the highlands of Korea spend up to 15 percent of their income and inhabitants of the Andean Plateau up to 25 percent, in purchasing wood fuel for household use.[142]

c. Barter

There are also instances of fuelwood being bartered. The people of Northern Luzon, in the Philippines, exchange a bundle of firewood (which will last a family of five for 4 or 5 days) for 2 or 3 chupas (1 chupa = 174 cc) of hand-hulled rice.[143] Kaplan notes that fuelwood is bartered for fish in the Lake Patzcuaro area in Mexico:

> The Sierras are lacking in any kind of fish resources but are still fairly well forested, while the island communities are almost totally denuded of trees. The people from the Sierra trade firewood and ocote (resinous pine) for fish supplied by the lake communities.[144]

The use of fuelwood as a barter commodity may increase in those regions where deforestation and decreasing wood availability vastly augment the value of this resource.

d. Theft

A minor but growing and unorthodox form of distribution involves theft. As fuelwood becomes scarcer and more valuable, so does it become increasingly an object of theft, and in many places it cannot be left outside, unguarded. Deforestation and fuelwood shortages have caused dramatic increases in firewood theft in the Philippines, and this has increased stress on existing social institutions.[145] In Tonala, Mexico, firewood is stolen from government property to fire glazing ovens.

Sometimes one of these vendors of fuel may take the risk of cutting branches or trees in the forested areas farther away, but he must then avoid the forestry inspectors along the highways and keep to back trails when bringing in the wood.[146]

2. Storage

Storage of wood is not a major component of the firewood distribution chain, but it is becoming more important where firewood is a commercial product. Nearly all households store firewood to some degree, collecting enough at once to last for two or three days. In some areas, firewood is collected during the dry season and stored for use in the wet season.[147] For example, in Upper Volta,

> During late April or early May, the women begin using wood which they collect daily or twice daily to stock for the rainy season. During the rainy season the women do not have time to collect wood, and dry wood is difficult to find.[148]

Seasonal storage is becoming more difficult, however, as firewood scarcity becomes prevalent in more areas. At the same time, scarcity is encouraging conservation in many areas, one form of which is slower use and longer storage of collected firewood. In that the energy value of wood is universally related to its moisture content, this storage of some firewood allows it to dry out more so that it provides more energy per unit weight.[149] Efforts to store firewood in anticipation of special needs are also made, as in the case of pregnancies or when heavy cooking duties will not leave time to gather firewood.

Some fuelwood sellers who foresee a boom in their market are beginning to invest in storage systems. Special traders in Ibadan use trucks to buy large loads of wood in the countryside, which they bring into town to store in one meter long by twenty centimeters in diameter bundles.[150] At present, each bundle sells for $1.65 U.S. but such fuelwood stores become more valuable everyday, as shortages become more acute. In Nairobi and other cities in Kenya, fuelwood storage "stations" have proliferated in the last decade; because of the high value of fuelwood, such places are invariably well guarded.[151]

3. Regional distribution: villages vs. towns or cities

The People's Republic of China has organized a detailed system of firewood distribution for both the rural areas in which it is harvested and for urban zones. In Tungfanghung Province, for example, shelter-belts constitute the principal firewood source.

The Tungfanghung production brigade collected some 3000 cubic meters of firewood from those areas between 1966 and 1976, which served to meet both its own energy requirements and those of other brigades. Brigade members purchase their own firewood at one-third of the market price, and any surplus is sold at full price to the State for distribution. The Tungfanghung production brigade made 319,000 uyan from wood sales during the period, the revenue being used to purchase machinery, fetilizers, irrigation materials and other implements.[152]

This distribution system represents the exception, rather than the rule for developing nations. Rural and urban communities most often compete for scarce firewood resources. Some analysts of the firewood situation claim that this competition results in rural dwellers facing serious shortages while urban needs are satisfied. Although in many instances this may be true, the situation is far too complex to lend itself to such a generalization. Thailand's efforts to increase forest land productivity through massive clear-felling and replanting have left forest communities with ample firewood, but have disrupted firewood supplies to urban, semi-urban and agricultural zones away from the forests.[153] On the other hand, many of the tea estates of India have been forced to supply kerosene oil bought in urban markets to their labor force because firewood supplies have not been able to keep pace with demand in recent years. The laborers spend their days caring for trees, yet there is not enough wood to provide for their domestic needs. The sustained supply of kerosene is not guaranteed, but bringing firewood in from other areas is costly and therefore undesirable.[154]

The outcome of rural-urban competition for resources in a given area depends upon the nature of the competitors: their occupation, income and political status. The burden of fuelwood shortages falls most heavily on the poorest groups, however, wherever they may live.

4. Discussion

The household is the usual center for the distribution of firewood, each household collecting for its own needs, according to ways laid down by custom and ecological dictates. Firewood scarcity does not necessarily lead directly to an alteration in household composition, and in accepted responsibilities, but scarcity of firewood is one of many factors that encourage the modification of rural households which in turn alters firewood distribution patterns.

In many areas, the process is one of shrinking size, from large extended households to smaller households based on a nuclear family. In this process, the socially marginal people such as the old, or handicapped, or unmarried mothers, are often left to fend for themselves; such people are often the hardest hit by the firewood shortage. Attempts to help resolve firewood shortages in rural communities should recognize the central place of the household in traditional firewood distribution patterns. They should also account for the special problems of weaker family members, or nuclear families with respect to firewood supplies.

There are few rural communities where all firewood is sold, and there are many where it remains a free good. Most rural people are part of a modified energy allocation system, however, somewhere between a totally commercial system and one in which firewood is available as a free good. It is becoming increasingly difficult to avoid the commercialized system in some areas. This has major effects on distribution patterns, as people increasingly have to pay for at least some of their fuel. Providing enough income to people to enable them to do so is a vital part of helping them meet their firewood needs. Such income could come directly from a firewood project itself or from a more comprehensive rural development program.

The role of specialized firewood traders is becoming important in some rural areas, raising the specter of price and volume manipulation. The interests of such persons are usually inimical to community interests in developing and sharing in a firewood program. On the other hand, the activities of such traders and the price mechanism in rural areas may provide a basis for using price to allocate firewood from a community firewood program, at least to some degree.

Less orthodox systems of distributing firewood include barter and theft, both of which are likely to increase in scale as the shortage becomes more severe. Sharing of wood resources between an owner and a wood cutter is not a significant distribution device, but has some promise for future fuelwood programs. Government regulation of firewood distribution is difficult. Increasing commercialization, however, will highlight problems such as firewood being harvested from restricted areas and trucked covertly to various markets, which can be monitored and somewhat controlled by government.

Some people have always managed to store firewood, especially when it was possible to build up a reserve in the dry season.

Others simply collected on an as-needed basis. Storage is becoming more common as firewood becomes more valuable and scarcer. Firewood storage by commercial traders can be expected to increase and may lead to market imperfections.

Distribution of fuelwood between urban and rural areas is already competitive and the competition will sharpen considerably in many areas in the future. Where rural-urban friction exists over firewood availability, the incidence of any opportunity costs (e.g., giving up "free" firewood to urban consumers) of a community fuelwood program on both sets of firewood consumers will have to be considered in determining how to distribute firewood from the program.

E. Consumption

1. Consumers

It is estimated that 1.5 billion people now depend on firewood and charcoal to meet their daily cooking and heating needs.[155] The household is by far the largest consumer of firewood, most gathering it from forest areas or trees within walking distance of the village. Close to 100 percent of the households in several countries identified in a World Bank study were using fuelwood (firewood and charcoal) to meet their energy demands: 99 percent in Gambia, 98 percent in Tanzania and 97 percent in both Sudan and Thailand.[156]

Both rural and urban people depend upon firewood (and charcoal) for their household energy needs. A Nigerian study, for example, found that over 60 percent of the rural, and at least 40 percent of the urban Nigerians still depended almost totally on fuelwood to meet their energy needs.[157] Most of the people depending on firewood, however, are in rural areas in developing countries, where over 90 percent of household energy overall is met by firewood.[158] Thus, firewood is very much the rural community energy resource. In most cases, women are at the heart of the household consumption group, where they direct the organization and utilization of firewood resources for cooking and other household purposes.

In general, 50 percent of the firewood used in rural areas is for cooking, 30-35 percent for heating air and for hot water, and the remainder for local or other agricultural and processing uses.

Local cottage industries also use firewood to meet their energy demands, but to a much lesser degree than households, and usually in combination with charcoal, kerosene, biogas, electricity or some other energy sources. Openshaw gives a breakdown of fuelwood consumption between household and non-household units for several countries in Table 3. Households consume 74 to 89 percent of fuelwood, local industry consumes seven to nine percent, and other industry uses two to 18 percent.[159] A study in Pura, India determined that 90 percent of the firewood consumed was for household purposes with four percent used by local industries and six percent by other industries.[160]

There is a general tendency among the middle and upper classes to change to petroleum based fuels or electricity, particularly in urban areas, although in some areas tradition may encourage the continued use of charcoal for cooking.[161] In fact, in Thailand, over 70 percent of the highest income group (six percent of the population) of households used fuelwood predominantly as their energy source. Openshaw notes that among the poorest classes in rural areas there is a tendency to increase firewood consumption as income levels rise, but not to switch to charcoal. In urban areas, however, the poor do switch to charcoal as their incomes rise because of increased status pressures.[162]

The physical availability of firewood supplies is the most important factor in determining who consumes firewood as well as how much they consume. Digernes writes that while price acceptability and "handiness" are all important, "availability is the most decisive factor."[163] She is echoed by Morgan, who states that "accessibility to resources is a most important constraint" regarding its use.[164] A study in India found that villages within, or next to, forests obtain all of their energy requirements from forest sources. Villages within 10 kilometers of the forest boundaries obtain from 70 to 100 percent of their energy from the forest. But those living beyond 15 kilometers from the forest consumed almost no firewood.[165]

2. Uses of firewood

a. Cooking

By far the most significant use of firewood in rural (and urban households) is to fuel the cooking fires, generally estimated at 80 percent of total fuelwood consumption.[166] In Pura, India firewood is the only fuel used for cooking, accounting for

Table 3 : Breakdown of fuelwood consumption between household and non-household use
(Unit - percentage of total consumption)

Country	Household	Cottage Industry	Industrial and Service Sectors	Cottage Industries	Industrial and Service Sectors
				- in some or all countries -	
N. Nigeria	75		25	baking	baking
Gambia	85	7	8	brewing	cassava drying
rural	(85)	(9)	(6)	blacksmith	tea drying
urban	(83)	(-)	(17)	fish curing	fish curing
Sudan		98	2	(heating animal food)	tobacco curing
					brick manufacture
Tanzania		93	7	(hot food traders)	ceramic manufacture
					cement manufacture
Thailand	84	7	9	(palm oil production)	metal manufacture
rural	(89)	(7)	(4)		blacksmiths
urban	(74)	(8)	(18)	(sweet making)	railways
					sawmills
					restaurants
					canteens

Source: Openshaw, "Woodfuel--A Time for Reassessment," Natural Resources Forum 3 (1978), p. 41.

82 percent of the community's total firewood consumption, or 8.3 kg of firewood used per family per day.[167] In Thailand and the Gambia, where virtually all households use firewood for cooking, 70 percent of the firewood consumed is used in food preparation.[168] Firewood composes 79 percent of all fuel used for cooking in the rural areas of Brazil, and 21 percent of that used in urban areas.[169] Tables 4 and 5 illustrate the predominance of firewood as the primary cooking fuel in the rural areas of Ghana, where it constituted 92 percent of the total cooking fuels, as well as 74 percent for the country as a whole.[170]

Cooking activities are carried out on open fires, open stoves or more efficient and sophisticated stoves, depending upon the country and the affluence of the user. Most rural households continue to use the traditional three stone open fire, although in Central and South America the use of more efficient stoves is being promoted in many areas.[171] Firewood is most often used in open fires to cook meals or brew beverages. The cooking fire serves many purposes, providing light, heat, protection from insects, etc. In Kwemzitu, Tanzania, from one to three fires per day are lit in order to prepare the meals. The first is lit at dawn and burns until breakfast is prepared, or until the last person leaves for work if it is cold. Lunch is prepared over the second fire of the day, which may be allowed to burn slowly until dinner if the air is cold. Otherwise, the dinner fire begins at 5 p.m. and may burn until 11 p.m. if people visit in the evening or if the night is cold.[172]

In addition to household cooking, firewood often fuels the cooking fires for small restaurants and institutions such as schools and hospitals in rural communities. It is also utilized to dehydrate food as a means of preservation in areas lacking refrigeration such as Nepal.[173]

b. Heating

Heating, although rarely the sole function of a fire, is the second major function of firewood in rural areas, consuming about one third of all fuelwood used.[174] Depending on the climate and geographical zone and the season, cooking fires are kept burning all day and into the evening to ward off the cold. Areas in the tropics have need for added heat during parts of the year - in Ethiopia temperatures fall to 8-10 degrees centigrade during December and January, thus necessitating heating fires or charcoal burners.[175] High altitude areas require significant additional fuelwood resources for heating, over four times as much as warmer areas not requiring heating fires.

Table 4: Main cooking fuels used in urban-rural households in Ghana, 1960 and 1971

	1960 Total Population	1971 Total Population	1960 Urban	1971 Urban	1960 Rural	1971 Rural
Firewood	80.1%	74.0%	47.7%	33.0%	93.0%	92.0%
Charcoal	14.6	22.0	43.5	59.0	3.1	5.0
Kerosene	2.0	1.0	5.3	2.5	0.6	.3
Electricity	0.2	0.6	0.7	2.0	0.1	.1
Gas	0.3	0.4	0.6	1.0	0.1	.1
No cooking		1.0		2.5		.7
Other	2.8	1.0	2.2	.0	3.1	1.8
Total	100.0%	100.0%	100.0%	100.0%	100.0%	100.0%

Source: Martin, "The Ecology and Economics of Cooking Fuels in Ghana," p. 8.

Table 5: Firewood and charcoal usage and urbanization by region in Ghana, 1971 (% of households using firewood and charcoal as main cooking fuel; % of population living in urban areas)

Region	Firewood	Charcoal	Urban
Greater Accra	10.0%	79.0%	89%
Central	76.7	20.7	28
Ashanti	77.5	20.0	28
Northern	93.7	5.5	25
Eastern	87.0	10.0	22
Western	71.0	27.0	21
Brong-Ahafo	90.5	7.3	17
Volta	88.3	9.8	12
Upper	80.6	4.0	7
All Ghana	74.0	22.0	28

Source: Martin, "The Ecology and Economics of Cooking Fuels in Ghana," p. 11.

In Gambia, heating and clothes ironing account for 34 and 8 percent of the household fuelwood consumption respectively. In Thailand, heating requires 15 and ironing uses 3 percent of domestic energy supplies.[176] Energy for heating, if separated or additional to that required for cooking, is increasingly a luxury which fewer people can afford; older people often complain about the cold in mornings and evenings.

c. Manufacturing

Many cottage industries and traditional manufacturing activities are almost entirely dependent upon fuelwood as their energy source, often involving specific preferred wood species which possess appropriate burning qualities.

> A host of cottage industries and small-scale enterprises employ traditional fuels. Small bakeries, cafe-bars, streetside food venders, blacksmiths and brickmakers all commonly use woodfuels . . . . Wood fuels are also used to brew beer, dry fish, tobacco and lumber, make bricks and manufacture cement.[177]

According to Knowland, in general, about 15 percent of all woodfuels used are consumed by industries. They include small local enterprises such as pottery, brickmaking, blacksmithing, and large-scale steel or other metallurgical industries which most often use charcoal.[178] Many of these industries, while preferring the more controlled heating qualities of charcoal, use a combination of the two or firewood alone, because of charcoal's higher price and sporadic availability, particularly in the rural areas. Those that continue to use firewood are the smallest, most localized or those that require some of the specific qualities of firewood industries.

In Brazil, which is fairly representative of other countries, bakeries, pottery and brick makers, tobacco and leather curers, furniture and wood processors, among others, are dependent on cheap wood-based fuels. The food-products industries are among the highest consumers of fuelwood, bakeries being the leading firewood consumers.[179] The industrial enterprises of Pura, India, include four pottery establishments and an electric flour mill. The potteries account for 70 percent of the industrial consumption of firewood, and the coffee shop for the other 30 percent; together, they use 8.9 tons of firewood annually.[180] The women potters of North Mexico use large pieces of thick pine and oak bark in their pottery making. Both species have been in short supply, causing problems for that local industry.[181]

In Tonala, Mexico, the situation is similar:

> Long ago all surrounding hills were stripped of hardwood trees. The potter must now make do with whatever he can: odds and ends of lumber bought from suppliers who have picked up scrap wood in the city, dry bushes and branches he himself gathers in the fields, or dry cow dung he brings from Tonala's gatherers . . . . Sawdust is used on occasion, while eucalyptus leaves brought from a stand of trees about ten miles away are considered a particularly good fuel for the second firing of glazed ware.[182]

In Nepal, bakeries, distilleries, breweries, brick and pottery manufacturers, fruit, cardamon, turmeric, tea and tobacco processors, cheese and clarified butter producers, metalcraft operation, paper factories, soap makers and brown sugar refineries all use fuelwood for their production processes.[183]

Fuelwood plays an important role in the drying and curing of fish in West Africa, Mauritania and Zambia, as well as other countries with substantial fishing industries.[184] Preservation by wood heat is widespread in Southeast Asia, and the Uganda tea industry uses wood for curing their tea crop.[185]

In Mbere, Kenya, tobacco (a recently introduced cash crop) makes great demands on firewood, as the curing process continues for six days and nights; it has been estimated that curing a hectare of tobacco requires the best ligneous vegetation from another hectare of savanna.[186] In Tanzania where there are 6,000 tobacco villages, about 50 cubic meters of fuelwood is needed per year for each hectare of tobacco cultivated. For every 300 cigarettes made in Africa, one tree is burned. (Preferred species include Uapaca kirkiana, Brachystegia, Cussonia, Faurea.) [187] Some analysts have found it easy to conclude that countries like Malawi are not exporting flue and fire-cured tobacco at all, but firewood instead.[188]

The brick and tile kiln in Kisarawe, Tanzania uses 20,000 cubic meters of fuelwood per year, most of it obtained from the natural forest although some is from nearby plantations of Cassia siamea and Eucalyptus. A Kaolin factory in the same area uses 50 cubic meters of stacked firewood per day for their 5-6 ton daily clay production. Wood is favored over electricity and oil because it costs half as much. Trema guinensis, Brachystegia, Acacia, Eucalyptus, and Cassia siamea are the preferred wood species.[189]

Lime producers also depend on wood to fuel their kilns. In Mexico, wood fires have traditionally been used for burning limestone to produce lime, consuming a considerable amount of firewood. According to Collier:

> The oldest informants can remember the time when timber was plentiful enough to fire lime kilns to supply the hamlet with lime for cooking the corn. Many of these traditional uses are becoming memories as the land area is exhausted of its resources by overuse.[190]

Other enterprises using firewood have included: salt and potash manufacturing in Niger, a process that consumed great quantities of firewood in order to boil saline water and extract the salt;[190a] and the smelting of iron by traditional manufacturers of spears, hoes and other iron ware in all regions of the world.

Each community manufacturing process is practiced by specialists who often rely on the sale of their products for all, or a significant part of their income. They are much affected, therefore, by any change in fuelwood availability. It is the small cottage industries, in particular, which are hurt by the growing firewood shortage as they are often unable to change to the more expensive energy sources of charcoal, oil, gas or electricity which the larger industries can do.

d. Other functions

In addition to the principal firewood consuming activities mentioned above, there are a number of lesser, but still significant activities which consume wood. Firewood has a number of functional roles, as kindling, torches and for making smoke as protection against insects and animal pests. It also plays a central role in many ceremonial and funeral functions.

For example, in Central America, ocote, the resinous heart of the pine tree, is widely used for kindling: "it makes wonderful kindling, since it will blaze into a hot fire." Cedar chips were also used by the Maya.[191]

In West Pasil, Northern Luzon, Philippines, "the inner parts of pine branches, saturated with resin and burning brightly, are used as torches -- even in walking the few metres from house to kitchen."

But "due to deforestation, flashlights, kerosene and sometime bamboo are used as torches in East Pasil."[192] The Mbere (Kenya) prefer one kind of wood (a slow smoldering type) for carrying a light from place to place, another for a quick light in emergencies or to tend a crying baby. One is preferred in the rainy season because it resists water and so dries quickly; another for the slow brewing process of marua, the local millet beer which takes three days.[193] In many areas pitch-pine, the nuts of the candlenut tree, and other materials are used as torches for nocturnal activities including honey-collecting, fishing and domestic duties. Today, a shortage of pine in many areas has led to substitute materials being used.

In Nepal, as elsewhere, the hearth fire creates smoke which protects stored grain and house timbers from insects and pests, and provides lighting in the early morning and evening hours after the sun goes down.[194]

The non-traditional use of fuelwood for wood-burning locomotives made great demands until quite recent years on tropical forest resources in Brazil and in Tanzania, to name only two countries which supported this consumption pattern. Pierson reports that "exporting firewood for use as fuel in the wood-burning engines of the railroad and in the factories of Sao Paulo is said to have begun about 1932. During World War II the cutting of timber for these purposes extensively increased."[195] Steamboats were also consumers of firewood. Until quite recently wood-fired boats were common on both the Niger and White Nile Rivers.

Ceremonial uses of firewood are widespread. In Mexico, the Tarascans were said to cut "enormous quantities of wood for their perpetually burning ceremonial fires" which lead to "a long history of erosion and sedimentation . . . . Sun worship (associated with fire) was the basic element in the Tarascan religion and the favorite rite and sacrifice was the burning of wood in the temples."[196]

The Mbere of Kenya attach symbolic importance to the household fire as a sign of hospitality and warmth.[197] In the Sahel region in general, the fire is the symbol of the health of the family.[198]

In addition to ceremonial fires, the wood itself or the gathering of it often has ritual significance.

> Among the Nuba of the Kordofan, a girl's dowry is a stock of firewood amounting to from thirty to fifty headloads, which is collected by the

> bride, her friends, and relatives in the years between her betrothal and marriage. The girl takes pride in this pile of wood, and if it falls short of expectations she is called a useless and lazy woman.[199] . . . . New fire ceremonialism, perpetual fires, funeral fires, and the like, which are widely known both in North and South America, all involve special and often ritualized gathering of the wood used in these fires.[200]

The ritualized use of firewood at Hindu cremations is a significant cultural tradition, but also a very large consumer of wood. According to Eckholm, a new and more efficient means of cremation

> which reduced the wood used in funerals from the usual 400 to 500 kilograms to just 160 kilograms, is already being pushed by foresters and a private social organization in Gujarat. In a country of 650 million where virtually all the dead are cremated, the new crematorium could save a significant amount of wood and also reduce family funeral expenses.[201]

Such developments are noteworthy because they enable the conservation of the scarce resource but do not force excessive changes or abandonment of rituals or traditions important to the people of a wood poor area. It is getting more and more difficult to hold on to such cultural traditions, however, because of both the economic and environmental pressures associated with them.

3. Changes in consumption as a result of shortages

a. Volume

As firewood supplies come to be farther and farther from the village, less and less firewood is consumed. A World Bank estimate states that firewood consumption declines sharply in rural communities when the remaining supplies become more than a day's walk away (approx. 10-15 km).[202] Arnold notes the same phenomena in India.[203]

b. Use patterns

Reduction in the quantity of available firewood and cooking fuels in general alters traditional consumption patterns. It affects the kind of food grown and consumed and reduces the number of hot meals eaten as well as the way they are prepared. Reduced firewood supplies encourage dietary changes as well. Food requiring less cooking time come to be preferred because of the fewer fires being made in general and the smaller fires used when they are lit.

In Senegal and much of West Africa, many families eat only one cooked meal per day rather than two, or even one cooked meal every other day, due to reduced wood supplies.[204] The same is true in Korea where the scarcity of firewood in many areas necessitates that rice straw be used for cooking; in some villages the available straw is only sufficient for cooking one meal per day.[205]

Possible nutritional consequences are many as traditional eating patterns are altered. In Guatemala women are abandoning their traditional beans in favor of faster cooking rice and a significant protein source in their diet is simultaneously lost. In the Sahel, people (particularly in urban areas) are now consuming rice instead of millet because of its faster cooking time. "In the peanut basin of Senegal one woman remarked, 'One can starve with a full granary if one has no fuel with which to cook the meal.'"[206] The Nepalese are consuming more and more food uncooked and are increasingly cultivating only those vegetables which can be eaten raw. This increased consumption of raw foods and unboiled water has potentially deleterious health effects from spreading diseases which otherwise would have been avoidable.[207]

These changes in consumption patterns due to firewood shortages have been found to have direct implications for future development programs and agricultural activities, as seen in Upper Volta and Haiti. In Upper Volta, soybeans were introduced as part of a large-scale development scheme and have grown very well. They have not been accepted by the local women, however, because of the markedly longer cooking time required as compared with their traditional cowpeas.[208] Similarly, in the wood-poor areas of Haiti, a major obstacle to the acceptance of new, higher nutritive-value food crops introduced has been the longer cooking time they require.[209]

Even more severe cutbacks are forced on people by the firewood shortage. The marginal members of society, (the old, infirm, blind, etc.) often depend on firewood to eek out a subsistence income through some kind of local manufacturing. In many areas of Mali and Niger, for example, dolo beer is made from millet by older women unable to participate in agricultural activities any longer and unsupported by an extended family. It is their only source of income. Firewood supplies are required for the process. Millet is available but firewood increasingly is not, particularly for these older people who lack the physical energy or the economic resources to gather or buy the needed wood. The limitations imposed by the lack of accessible firewood is serious for these older women, as for most marginal rural residents who are unable to use alternative energy sources and whose very existence is threatened.[210]

c. Conservation

Conservation is another response to the firewood shortage, and many regions have promoted the development of more efficient cooking stove designs requiring much less wood than open fires or traditional stoves. Improved designs of mud, clay, or other enclosed stoves like those used in India, Indonesia or Guatemala, might be able to save from one-half to two-thirds of the amount of fuelwood required by the traditional three-stone hearth used in many areas of Africa.[211] Efficient wood-burning heating-cum-cooking stoves could "cut in half fuel requirements for families living in cold areas of China, thus relieving the country's critical wood shortage."[212]

The Lorena stove, considered by some to be the most promising new design, was developed in Guatemala and is said to be gaining acceptance in rural Mexico and Guatemala. It is being introduced in Java as well.[213] The degree of success varies, however, in different geographical areas.

> In some instances a given design appears to significantly reduce fuel consumption. In other homes using the same stove, no saving is apparent. A great deal seems to depend on how well the individual stove is constructed, and on the cooking practices of the cook.[214]

Martin's study in Ghana illustrates how the stove must be designed or adapted to meet the specific needs and traditional practices of the area: stoves were rejected because they were too high for sitting on a small stool while cooking as they had traditionally done;

because the new stove required larger pieces of wood which meant a farther walk to find them; because holes were not big enough for some of the common sized pots, etc.[215]

In India the Hyderabad Engineering Research Laboratories designed a smokeless chula stove made from available earth, clay, or bricks that operates using 20 to 40 percent less fuel than traditional style mud chulas. However, rural people were not persuaded sufficiently to make the extra effort needed to construct the new stoves.

Solar cookers are also an option being considered in areas with fuelwood shortages, but there are more potential problems than with the stoves. So far, despite twenty years or more of imaginative experiments, there is still no culturally acceptable solar cooker which can satisfy African cooking styles and working hours.[216] Traditions of cooking inside and after dark are very common throughout the world.

The enforced conservation of firewood caused by a supply shortage does not mean that people will continue to use lesser amounts of firewood if the supply again expands. In Nepal, the peasants who migrated from the higher wood-poor hills to the lower forested Terai region now use twice as much firewood as those who remain in the denuded hills.[217] One must always assume an unsatisfied demand for firewood.

d. Use of alternative fuels

As firewood supplies become scarcer and collection areas move farther and farther away from the villages, firewood is replaced or supplemented with alternate energy sources which are more easily available. Worldwide studies have documented the increased usage of crop residues, local plant stalks and animal dung in rural areas, in response to such shortages.[218] Smil suggests that the total annual use of fuelwood amounts to about 78 percent of the total energy consumption filled by traditional energies, while crop residues and byproducts are 17 percent and dung is five percent of the total.[219] Earl makes somewhat similar estimates -- out of a worldwide estimated total traditional energy consumption of 587 million tonnes coal equivalent, 82 percent is fuelwood, 16 percent is crop residues and 2 percent is animal dung.[220] The difference between the use patterns of traditional energy sources in individual nations is noteworthy -- several country figures are presented in Table 6.

Table 6 : Traditional Energy consumption

Country	Non-food Traditional Energy (Percentages)				Total non-food energy filled by traditional energies (percent)
	Fuelwood	Crop Products	Dung	kcal/day/capita	
Bangladesh	6	60	34	3200	86
Nigeria	92	8	-	7600	82
Indonesia	97	3	-	6700	66
India	62	13	25	3900	48
Brazil	87	13	-	6900	35
Turkey	44	22	34	5900	33
China	35	65	-	5100	27
Taiwan	33	67	-	300	1

Source: Smil, "Energy Flows in the Developing World," American Scientist 67 (1979), p. 529.

Charcoal use is also increasing, particularly in urban areas and by industries, but also in rural areas as wood supplies recede from consumption areas.

Animal dung is a major fuel alternative throughout the world. It is readily collectible, but its use as fuel significantly reduces land fertility because it would otherwise have been used as fertilizer. One estimate indicates that for every ton of cow dung burned, about 50 kg of food grain production is lost.[221] Among the Aymara in Bolivia, Llama, sheep, cow and horse dung all provide fuel.[222] Similiarly, in Iraq "animal dung is widely burned; firewood is almost non-existent."[223]

In a Highland Peruvian community the scarcity of wood sources has resulted in a near total conversion to dung as the household energy source.

> Eighty-seven percent of the Quechua families interviewed used animal dung rather than wood or kerosene as a cooking fuel. This situation, for the majority of rural people, arises out of necessity.... Wood is an economical alternative available to a few families. However, the very limited and slow-growing stands of quenua are a rapidly exhaustible resource; consequently, they are not heavily exploited. Availability at limited expense, coupled with acceptable fire characteristics, makes dung the preferred fuel.
>
> While most families interviewed preferred cattle dung, a typical fire contains both cattle and camelid dung, kindled with a handful of grass ....
>
> The dung fire required 28% by weight more fuel than did the wood fire, but produced comparable temperatures over the fire, and identical food temperatures.... Wood collection generally involved more time, and greater effort at times, than dung collection.
>
> The high efficiency of dung and wood fuels relative to kerosene reflects the natural availability of these fuels. Fuels collected from camels have a higher efficiency because animals are supplying

> the energy to transport the fuel to a convenient gathering place. With the restrictive aspects of the two superior fuels, wood and kerosene, the Quechua have chosen to rely on animal dung. Their judicious selection of available dungs and their mastery of dung fire construction make these fuels a satisfactory substitute for wood.[224]

Crop residues are available in all agricultural areas as a substitute for firewood. Crops are increasingly being selected or developed for their multipurpose qualities - food production, soil enrichment, suitability as animal fodder and as fuel resources. In the Bangladeshi village of Dhanishwar, where firewood provides only about seven percent of household requirements, the deep-water Amon paddy, the most important crop, contributes the husk, the straw, and to some extent the leaves for uses as fuel following the harvest. The rice straw provides 75 percent of the fuel used for cooking and jute sticks (also used for construction) provide another 15 percent of the cooking fuel.[225]

In parts of the Sahel, crop residues such as millet stalks provide the major fuel source for several months of the year, following the harvest of the millet crop. In one area of Upper Volta, these stalks are in fact preferred because they can be collected for fields around the village and thus are more accessible than the firewood supplies, are easily stored and are just about the right size for the cooking fire.[226] Martin includes the feelings of women interviewed in northeast Ghana who "burn millet stalks even though they prefer firewood because firewood is too expensive, in short supply or too far away." They consider the stalks as inferior fuel because they burn more rapidly than wood and necessitate more care while burning.[227]

Among the Aymara in Bolivia:

> Yareta and lola are the chief vegetable fuels. Yareta is a curious plant, much like a semi-subterranean, woody, resinous cauliflower, only the curved surface of which appears above ground. Botanically, it is one of several umbelliferous plants.... These are all scrubby, resinous shrubs which grow in the semi-desert regions of the Bolivian plateau. After being cut and dried in the sun, they are tightly baled and transported to the villages and cities to be sold as fuel.[228]

In the Altiplano of Northern Chile, as well, villagers collect and burn a moss/cactus-like plant, almost like peat, which grows in large mounds and can be cut and burned for cooking and heating.[229]

Driftwood is gathered by many coastal peoples, including the Seri Indians of Northwest Mexico, as are coconut palms to supplement firewood sources.

In addition to dung and crop residues, there is limited utilization of technologically advanced energy sources such as electricity, biogas, wind and solar, but they are generally not yet feasible for meeting general energy requirements in the rural community setting. Those people unable to obtain sufficient traditional energy supplies will have even less access to these new energies requiring investment in equipment to produce or utilize the energy.

Even with the above options, the tragic truth is that although the growing scarcity of firewood is recognized, lack of alternative fuels, or alternative economic opportunities in many areas locks local people into a progressive destruction of their resources through the continued harvesting of forest supplies. "We must live from something, what else can we do?"[230]

e. Discussion

A vast member of people in the world consume firewood; rural households in developing countries, however, are the primary consumers. For them, firewood is the fuel, providing nearly all their needs for cooking, heating, lighting, ceremonial occasions, protection from insects, cottage manufacturing and other activities.

Cooking uses most of the firewood in rural areas, with heating using the second largest percentage. Any improvement in the efficiency of either use of firewood with improved stoves or burners is therefore especially significant for village consumers, governments and others concerned about the adequacy of fuel supplies.

Manufacturing, both locally and nationally, uses a substantial amount of firewood (and charcoal). Smaller community industries use mostly firewood. Any substantial growth in the activities of numbers of small cottage or local industries will increase the demand for firewood. Thus, attempts to generate small-scale agro-industry, etc. in the rural area for employment and other purposes will depend upon the existence of an adequate firewood resource. They should also consider the potential alternative energy sources that exist or might be developed within the local situation. The

processing of some export crops such as tea or tobacco require immense quantities of firewood; development of the production of such crops will usually require development of a parallel firewood project.

Ceteris paribus, people with the easiest access to firewood consume the largest amounts of it. As the distance between consumers and their firewood source increases, the quantity of firewood they consume drops until, at about 15 km, it may drop precipitously. One reasonable criterion for determining the degree to which a village needs a community fuelwood program, then, is the availability of firewood within easy walking distance.

Firewood plays a central role in many ceremonial and funeral functions. Maintaining these functions is important culturally, but in many areas it requires either production or conservation of enough firewood to enable them to go on. The choice between eating, and being warm, and the continuation of traditional customs and ceremonies is not an easy one to make.

Shortages of firewood relative to need creates unpleasant results for many rural and urban people. Households first look for alternative fuels -- crop residues, dung, kerosene, etc. -- to maintain their level of fuel consumption. Some succeed, but at a cost either in terms of the ecological balance and agricultural productivity they can attain or the other economic wants they forego. Others do not find alternative fuels or cannot afford them; they use less firewood, cook less food and stay "colder." They may grow different, faster cooking, but less nutritious crops or crops they can eat raw.

Local manufacturing and employment may suffer due to higher firewood prices or less firewood. Additional growth of cottage industries is difficult too because of the lack of firewood, the most basic input.

Conservation of firewood may become more important, with new stoves, fewer and smaller cooking and heating fires, and fewer fires for ceremonial occasions. These and other conservation efforts tend to come too late and to arise almost solely out of crisis. Ideally, they will be an integral part of any community fuelwood program along with fuelwood production and development of alternative fuels before the crisis is at hand. Conservation

and the development of alternative energy sources are particularly important regarding small scale industries because of the larger savings that can be effected as each individual business changes its consumption patterns in contrast to individual households. Each conservation measure should be carefully adapted to the local situation. Simple fuel efficient stoves, for example, have failed in most areas and there are still many problems to be worked out before they will gain widespread acceptance in rural communities.

It is widely known that conservation works best when it is forced on consumers by necessity; as community fuelwood programs succeed in increasing firewood supplies where scarcities previously existed, consumption levels will quickly return to old or higher levels. One must plan for this with the community from the outset of the program.

III. CHARCOAL

A. Introduction

1. Charcoal vs. firewood

The socio-economic aspects of charcoal production and use at the community level are similar in many respects to those for firewood. There are, however, some distinct differences. Charcoal, for example, is primarily produced for sale, especially in urban areas. It is mostly, but not exclusively, purchased by wealthier people. Charcoal production tends to take place at greater distances from its end market than does firewood harvesting. In most cases, the production of charcoal is inefficient primarily because of the production methods used. Finally, most charcoal production uses hardwood, thus heavily depleting hardwood forest resources in some areas.

2. Characteristics of charcoal

Charcoal is carbonized, or partially burned, wood (or other raw material), as opposed to wood that is fully burned so that the only residue is ash. Conversion of wood (or other raw materials) to charcoal involves drying and coaling. By regulating the airflow into the charcoal kiln, wood is first dried (by the heat generated from its own burning) then further heated to the point where charcoal rather than ash is produced from the remainder.

Charcoal is produced in "mounds" and in numerous kinds of kilns, all of which make some contribution to controlling the rate of burning of the wood (or other raw material) so that gases released as wood carbonizes are used to carbonize additional wood rather than burning the existing charcoal into ash. Charcoal can be soft and crumbly or hard and brittle, depending on the carbonization conditions and original wood density. Sometimes charcoal is compressed into briquets using a 10 percent starch binder, primarily to improve its handling qualities.

Charcoal has a moisture content of less than 5 percent and is relatively easy to ignite. It burns evenly, providing a concentrated and steady heat with little smoke or flame and is easy to store because it is non-hygroscopic. Its calorific value is about 7420 Kcal per kilo, and it has an efficiency of 20-30 percent in an open

cooker (1950 Kcal per kilo). This is 7.5 times higher than dry wood (moisture content of 25-30 percent) which has a calorific value of 3500 Kcal per kilo and a system efficiency of only 5 to 10 percent, resulting in an average fuel value of 260 Kcal per kilo. Put another way, 7.5 times as much wood by weight and twice as much wood by volume as charcoal must be transported and used to obtain the same fuel value.[1]

When transport distances are long, charcoal has a distinct cost per Kcal advantage over firewood. A rule of thumb based on East Africa data is that charcoal production cost plus transport equal firewood production costs plus transport when trees are 50 miles from the final users of their energy. Within a 50 mile radius of final users firewood is cheaper, whereas beyond a 50 mile radius, charcoal is cheaper. Similar relationships between the distance of firewood and charcoal from consumers and their relative costs exist in all areas. Figure 1 illustrates the conceptual relationship between total firewood and charcoal costs and distance from their production point to their end market.

3. Source of charcoal raw materials

Charcoal can be produced from a wide variety of materials, but hard wood is the primary input. Most wood used in producing charcoal at the community level in developing countries is gathered from unmanaged natural forest or savanna areas fairly near the end users for the charcoal, although some charcoal is produced at great distances from where it will be used.[2] Very little charcoal is made from intensively managed forest resources at either the community or national level. Some efforts, however, have been made[3] or are underway to develop charcoal production as a part of managed afforestation efforts.[4]

4. Adequacy of charcoal supplies

Charcoal demand, like firewood demand is increasing rapidly in many rural areas. As a result, supplies are falling below effective demand where charcoal is a traditional fuel.[5] Where charcoal has not been used traditionally, charcoal supplies also tend to be inadequate as consumers try to shift from other energy sources (firewood, petrol, etc.) because of price or availability problems.[6] The future adequacy of charcoal supplies is not at all certain either. In Ghana, for example, demand for charcoal is expected to increase nearly four times over 1977 (Table 7). Much of this increase is expected to come from the industrial sector, which

Figure 1 : Relationship between total costs for firewood and charcoal and distance from production site to point of consumption.

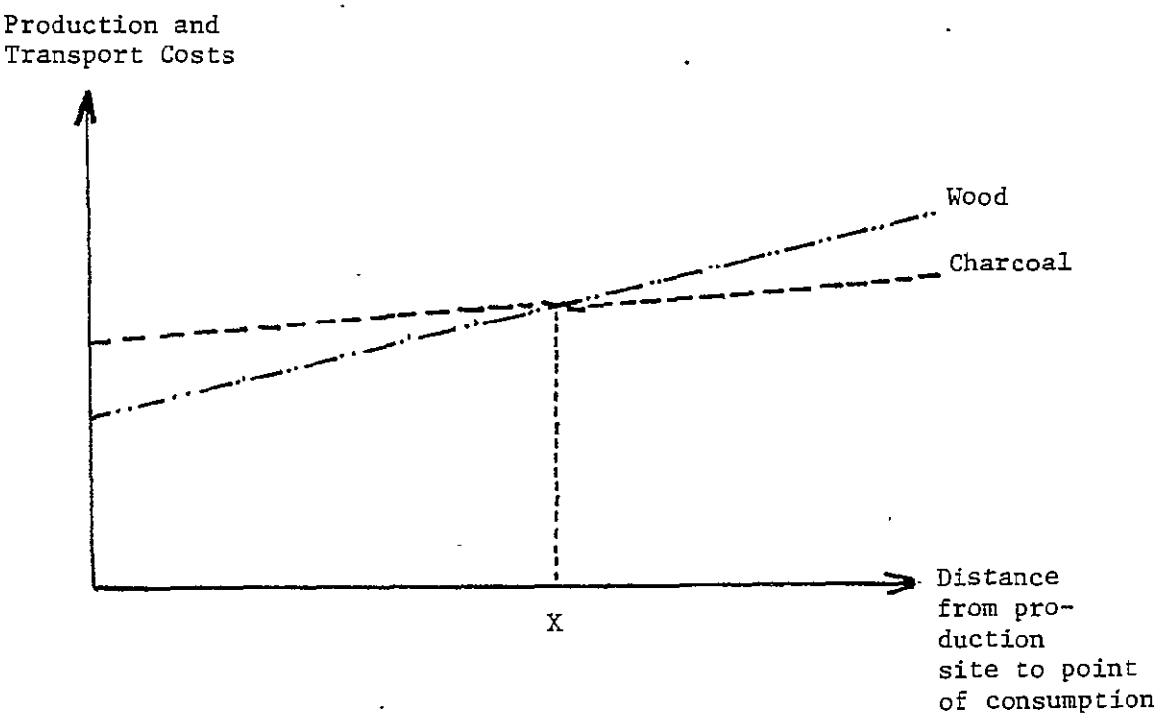

Table 7: Present and forecasted demand for charcoal in Ghana, 1977 to 1990
(in tons)

Sector	1977	1982	1990
Rural	23,000	25,000	27,500
Urban	137,000	175,000	257,000
Industrial	-	166,000	300,000
Total	160,000	366,000	584,500

Source: UNDP , "The Development of Forest Energy Resources in Ghana," project paper of the United Nations Development Programme, revised 7 October 1977, p.4.

probably will be able to out compete households in the event of fuelwood shortages which, in the case of Ghana, are expected.[7] In that most charcoal is produced in rural areas for consumption in urban areas, such shortages of firewood in most rural areas either decrease charcoal availability and increase its price in urban areas or result in decreased firewood availability for rural people.

5. Price and availability of alternative fuels

Charcoal has become an increasingly important energy source (especially in urban areas) in developing countries as other fuels have increased in price or decreased in availability, and it is expected to become even more important as a fuel in the future.[8] Even where other fuels are available and can be afforded by wealthier people, growing affluence of lower and middle-income urban and rural families in some areas enables them to use charcoal, thus increasing demand for it as a principal energy source.[9]

B. Access

1. Unregulated

Much of the developing world's charcoal production comes from forested areas where access to the wood is not regulated in any official way or where regulation of access is not effective (as has already been pointed out in the case for firewood above). Lack of official or effective regulation of access to wood supplies for charcoal production (and firewood) is evident in the Sudan, Kenya, Mexico, Malawi, Nigeria, Ghana, Tanzania, and other countries.

In these and most other countries wood for charcoal production is considered to be a "free good". Around the town of Bara, Sudan, professional charcoal producers burn trees on common open land. Deforestation has reached the point where they now operate 25 km away from Bara.[10] In Isiolo, Kenya, charcoal is the usual source of energy for cooking. Use of trees for charcoal was prohibited within three miles of the town in early 1974 to counter soil erosion. Beyond three miles, however, access to wood for charcoal production is unregulated.[11] In Tepoztlan, Mexico, where there is unregulated access to communal forest resources, wood for charcoal production is collected free by specialized charcoal burners and many small farmers.[12] Customary land accounts for nearly all of the land in Malawi. Access to wood for charcoal production (and firewood) on such land is uncontrolled for all village families.[13] Around

Ibadan, Nigeria, fuelwood for households is still regarded as a free good. If it is needed, it can be taken from anywhere, even from the farm of a neighbor, provided the land is under fallow. Most charcoal used in Ibadan comes from the savanna area to the north. This is "bush", in which access to wood supplies for charcoal production by specialists is not regulated. As the hardwood needed to produce charcoal has become increasingly scarce near Ibadan, the producers go farther and farther into the bush area to find appropriate trees. A forest reserve near Ibadan provided wood for charcoal production by the Forestry Division of the Nigerian Government, but producers could supply charcoal more cheaply so government charcoal production was halted.[14] In Ghana, Martin reports that firewood is considered to be a free good and that it can still be found in most rural areas. As long as it is free, few rural people are willing to pay for another fuel, including charcoal. Those rural people who do make charcoal have unregulated access to the wood needed to do so.[15]

The Fluerets report that the inhabitants of Kwemzitu village in Tanzania are allowed access to a nearby forest reserve, but they can gather only downed wood, fallen trees, branches and usable remnants left by licensed timber cutters. Women in the village, especially the poorer ones, make charcoal as well, evidently from wood in the same forest reserve.[16]

2. Means of regulation

While unregulated or ineffective regulation of access to wood for charcoal is wide-spread in developing countries, there is also regulation or restriction of access to wood for charcoal (and firewood) that is more or less effective as well. Such constraints take numerous forms, including government controls, land tenure patterns, natural barriers, and informal and economic means.

In Kenya charcoal production within three miles of Isiolo was prohibited by the town. While done to control land degradation, it resulted in substantial charcoal supply and price problems for Isiolo residents. Charcoal is often produced within the three mile limit at night to avoid the police.[17] In Mexico, government permits are required to cut trees for charcoal production, but large amounts of illegal cutting do go on anyway.[18] In Cajolá, Guatemala, permits are required to cut trees from communal land for charcoal production.[19] Access to wood on government controlled land in Malawi by anyone other than local villagers requires a permit and payment of a fee.[20] Trees are often purchased from private land owners by charcoal makers, which is another kind of regulation of access.

This is also reported for the village of Chinautla,[21] and Cajola', Guatemala,[22] and in Lebanon.[23] In Puerto Rico, coffee hacienda workers are allowed by hacienda owners to turn the wood made available by thinning coffee shade trees into charcoal. The owners receive half the charcoal produced.[24] Similar arrangements are made in Ghana where one fourth of the charcoal produced is given to the land owner providing the firewood.[25]

Natural factors are important in determining access to wood for charcoal production throughout the developing world. In Kenya, for example, much of the country is covered with the hardy "thorntree" of the Acacia genus. It makes excellent firewood and charcoal. However, the east and northeast parts of the country are also covered with Commiphoras species, which makes reasonable firewood but poor charcoal. Fertile areas in Kenya with enough rainfall to support both agricultural crops and trees are relatively scarce.[26] In Ethiopia, the environmental conditions are very severe in some areas where enough wood is available to produce charcoal. Drinking water, for example, has to be hauled many miles to such areas.[27] Charcoal is produced in such remote areas in the Ibadan region in Nigeria that it must be headloaded for long distances to the nearest collection point.[28] Indigenous forests being replaced with industrial forest plantations in Malawi are so far from firewood markets that existing forests are burned off rather than marketed as firewood. Charcoal is not a traditional fuel in the country, but some attention is now being given to converting such wood to charcoal.[29] Similar problems exist in Sri Lanka.[30]

3. Changes in access as a result of shortages

Shortages of wood does impact on access to raw materials for charcoal production. The two main impacts of such shortages are the difficulty of obtaining wood caused by increased distance and time requirements and the use of wood that produces poor quality charcoal.

In the Sudan, Ethiopia, Kenya, Tanzania, Ghana, Mexico and other countries, shortages create greater transport costs and additional labor requirements for producing charcoal. In some countries, such as Guatemala, "carboneros" are beginning to meet their counterparts from other villages also in search of wood to make charcoal.[31] In the Mexican village of Tepoztlan, a rift developed between those needing to cut increasingly scarce trees for charcoal and those emphasizing conservation.[32] Loads of thorny shrubs are gathered

from nearly denuded mountains in Afghanistan to make charcoal. The mountains are so far away that only one trip per day can be made.[33] Near Sao Paulo, Brazil, the shortage of wood resulting from population growth has pushed charcoal makers into the position of social isolates because they must live in remote areas where they are visited by a truck once a week which picks up their charcoal.[34]

In Ghana, charcoal producers are finding the savanna species Anogeissus that they prefer for charcoal making to be increasingly scarce. Consequently, they are turning to reserve forest land (where government permits, etc. are required), even though they find it harder to get their trucks into such areas and dislike the covering matter for their "mound" that is available in the forest areas. In the past the government had difficulty selling wood from these areas for fuel.[35]

C. Production and Transport

1. Degree of Commercialization

Charcoal production is carried out by individuals and families for their own use; it is also carried out by "professionals" and "associations" on a full or part-time basis for sale to others. A much higher degree of commercialization exists in charcoal production and marketing than in firewood harvesting and marketing.

Individuals and families produce charcoal primarily for their own use in nearly all developing countries, but this activity accounts for only a small part of total charcoal production. This is true in Ghana, where some individuals find it cheaper to make their own charcoal.[36] In Malawi (where little charcoal is mass produced) charcoal is made by families for their own use.[37] Every male is a charcoal maker by tradition in Chinautla, Guatemala, although charcoal making is declining.[38] Charcoal making in some cultures, however, is viewed as "dirty work." In many areas such as Tepoztlan, Mexico,[39] Brazil,[40] and Guatemala[41] it is an activity carried out almost exclusively by poor people. In some places, such as Kenya, wealthy persons are mocked if they make charcoal.[42]

Specialists produce charcoal for commercial purposes in nearly all countries on both a full and part-time basis, and their activities account for the bulk of total charcoal production. In Guatemala, individual families produce charcoal and market it from

door to door in cities such as Quetzaltenago. Large commercial sales are not the norm in the muncipality around Quetzaltenago, but sizeable truck loads of charcoal are moved to towns other than Quetzaltenago where the charcoal also is sold from door to door.[43] In the village of Chinautla in Guatemala, each charcoal maker has a regular buyer who expects his allocation of charcoal each week. Some charcoal producers sell their excess charcoal directly to urban customers as well.[44] Charcoal is transported great distances to be sold to households in Bara in the Sudan.[45] Near Isiolo in Kenya, some Turkana, Bula Geri and Bula Boa households specialize in producing and marketing charcoal in the town. The Turkana sell to households, the Geri to Somali hotelis.[46] Specialized charcoal burners can also be found in parts of Mexico,[47] Lebanon,[48] Brazil,[49] India,[50] the Ivory Coast, and many other countries. In the Sudan, charcoal production teams are organized by a wholesaler who provides the team with food, tools and drinking water and buys all its charcoal output. The wholesaler provides all the bags for bagging charcoal and transports the charcoal to market. During the rainy season when the roads to market are impassable, the wholesaler arranges central storage for the charcoal produced.[51] Charcoal is produced by specialists in the Ibadan area of Nigeria who learn their job as apprentices to other charcoal producers. The specialists are helped by their family or by laborers employed on a daily basis.[52] In Iran, villagers produce charcoal for the larger towns.[53]

Commercial charcoal production operations are managed by cooperatives or governments in some countries. Charcoal kilns are owned and operated by the Ashanti and Central Region Corporations and by the Forestry Department in Ghana.[54] In Malawi, the Forestry Department owns and operates a metal kiln on a pilot basis and plans to expand its charcoal production activities with the help of the World Bank.[55] In Tepoztlan, Mexico a cooperative society produced charcoal for a short time in the 1930's.[56]

2. Technology and costs and efficiency of production

Charcoal is produced in a variety of ways. The amount of charcoal produced per ton of wood material depends primarily upon the degree to which the combustion process in the kiln is controlled and the type and moisture of the wood being used. Traditionally, pit kilns or stacks of wood covered with earth have been used to make charcoal. These methods are inexpensive in terms of the capital required and labor intensive. They are inefficient, however, producing only 8 to 12 percent charcoal by weight from the air dried wood used.

Other types of kilns that increase this efficiency factor have been available for some time and recent concern about the energy crisis has led to the development of even more types of charcoal kilns to convert wood efficiently into other forms of useable energy. Most such kilns are expensive, however, and several are still in the pilot stage of their development. Moreover, most are fairly large scale, thus making them less attractive for use in many locations than smaller pit or mound kilns.[57]

The production of charcoal at the village or community level is almost exclusively done in pit kilns or "mounds" covered with earth or other materials. Pit kiln production utilizes a pit in the ground usually 2-3 feet deep. The shape of the pit may be circular, rectangular or square. It is as large as necessary to accommodate the wood to be burned, but seldom more than 10 feet in diameter or length and width. Sometimes large logs are laid at right angles to the stacked wood to aid in firing the stack.[58] Once dug, a pit is usually maintained in good condition for as long as there is a supply of wood in the area.[59] The wood stacked in the pit is usually fired first then covered with earth, grass and a variety of other materials to control the rate and degree of its carbonization.[60] Some charcoal burners cover the wood first, however, then fire it.[61] Mound production techniques involve stacking the wood, usually so as to enable some air to flow through it from one end of the mound to the other. An attempt to control the air flow reaching the wood is often made. Some pit kiln and mound covering materials other than earth are more desirable than others, as is the case in Ghana where savanna vegetation is preferred to that available in forest reserve areas.[62]

The out-of-pocket cost of both the pit kiln and mound charcoal production methods is nil. The only inputs required are a shovel and an axe or saw and the labor of the charcoal producer. The efficiency of both these production methods, however is low. The charcoal produced is only eight to twelve percent of the weight of the air dry wood used.

Various other technologies are available for producing charcoal on a relatively small scale. These include stationary masonry pit and upright kilns, metal kilns and mobile metal kilns. Stationary masonry kilns include the Missouri kiln, the Katugo kiln, the beehive kiln and numerous others, such as the Cusab and Tranchant kilns. A comparison of the cycle, investment costs, output and life of these general types of charcoal kilns and retorts is presented

in Table 8 . The Missouri kiln is large, handling about 150 m^3 of wood, and rectangular with two end doors. Production per cycle is 15 to 20 tons of charcoal, or about 20-22 percent of the weight of air dried wood. Investment costs for the kiln are US $2000 or so, depending upon where it is built.[63] The Katugo kiln is masonry with a metal roof. It handles about 25 m^3 of wood producing three tons of charcoal per eight to ten day cycle, with a yield of about 20 percent of the weight of air dried wood. Its investment cost is about US $1000. The beehive kiln is entirely masonry construction, handling about 50 m^3 of wood producing around five tons of charcoal per 15 day cycle. It produces about 18 percent charcoal on the basis of the weight of the air dried wood input. The construction cost of the kiln is about US $2000.[64]

Several portable steel kilns have been developed primarily with developing countries in mind. They can handle four to 10 m^3 of wood per firing and have a 20-22 percent efficiency factor. Their cycle time is fairly fast, approaching two days in some cases. The investment cost for portable steel kilns is relatively high (US $1000 or more) because of the imported materials required for their construction.[65]

Even more advanced kilns are available that convert wood into charcoal and also capture the gases formed during the combustion process.[66] Likewise, wood distillation techniques are available which were very popular in the 1930's in the industrialized countries. These processes capture all the gaseous and residue products given off by wood, resulting in an effective calorific value of 1.58 of the original wood burned alone. This high efficiency results from the more efficient use of the wood by-products than can be obtained by direct combustion of wood.[67]

3. Labor

The labor requirement for charcoal production at the village level is substantial. The wood used for most charcoal production is hardwood, which is difficult to cut with an axe or handsaw. It is sometimes moved substantial distances to get enough together to be worth firing the stack. Also, the digging of a pit and covering the stack of wood is done by hand. Charcoal is often carried in the same way at least for some distance. Not only is the physical labor hard, but it is "dirty" as well.[68] It is also thought to be unhealthy and to lead to respiratory problems.

Table 8 : Kilns versus retorts

Type	Total cycle (including cooling off)	Investment ($US, 1976)	Output (in % of air-dried wood)	Life of device
Earth stack	5 days to 3 months (depending on capacity)	none	8-12%	one firing
Pit kiln	1 week (for 23 steres capacity	100-200 (for digging, masonry lining, and covering with sheet metal)	12-15%	1 to 2 years (for a masonry-lined pit)
Portable metal kiln	2 to 3 days	1,500-2,500[1]	15-20%	2 to 3 years
Masonry kiln	7 to 10 days (for a 30 stere kiln)	1,000-2,000[2]	15-22%	5 to 7 or up to 10 years[3]
Continuous kiln or retort (Lambiotte type)	10 hours	300,000-3,000,000 (sold in Africa)	20-25%	20 to 30 years

[1]These kilns are made of special imported steel, the price of which has risen greatly.

[2]These kilns are built out of local materials, none of them imported except for the metal roofing or sometimes the chimneys.

[3]Normal reparation work is taken for granted.

Source: Uhart, "The Wood Charcoal Industry in Africa," 1976, p. 11.

Charcoal is produced by men, women and children. In Tanzania, women are responsible for producing the charcoal, at least in some areas.[69] They and their children assist their husbands or other male members of their family producing charcoal in Nigeria,[70] Ghana, [71] Guatemala,[72] and other countries. Women have been replaced as the main charcoal suppliers in the Sudan by men because of the long distances and conditions involved in making charcoal in the outlying areas where the necessary wood is now located.[73] Men produce the charcoal in many areas, including Guatemala,[74] the Sudan,[75] Mexico,[76] Lebanon,[77] Puerto Rico,[78] Kenya and other countries.

4. Distance and frequency of trips

The distance and frequency of trips to make charcoal varies a great deal from country to country and area to area within countries. It depends mostly upon the location of the wood used to make charcoal in reference to the market for it, but also upon the degree and consistency with which charcoal is used by consumers.

In the town of Bara in the Sudan, charcoal producers go 25 km or more to find trees to make charcoal.[79] Charcoal is regularly hauled 300 km or more by truck into Khartoum, the capital city, over very rough seasonal roads. During the rainy season the roads are impassable. No trips are made by river because the charcoal producing areas are not near the waterways in the city.[80] In Kenya, charcoal is hauled 130 km to supply the Marsabit area in the north. In Guatemala the distance from town to charcoal producing areas varies substantially. In Chinautla, for example, men seldom walk more than an hour to obtain adequate wood.[81] In Cajola, however, cutting sites are a considerable distance away requiring the carboneros to leave home at dawn to reach the sites by noon.[82] In Isiolo, Kenya, charcoal must be produced beyond a three mile radius from the town.[83] In Afghanistan the trip to the charcoal wood cutting site is so far that only one trip can be made in a day.[84] Charcoal production takes place within easy walking or bicycling distance of the town of Mpulungu in Zambia, however.[85]

The frequency of trips from a village to the charcoal production site varies by area and according to who is making the journey. In some parts of the Sudan, near Sao Paulo in Brazil and in numerous other countries, charcoal burners travel to the cutting site from their home villages infrequently, remaining at the site

of their work for several days or even months.[86] In most cases, however, charcoal producers travel from their home villages to and from cutting sites on a daily basis.[87] In certain areas, as much time is spent walking as in cutting and carbonizing the wood.[88] Sometimes there is a need to guard the wood cut after it is cut or the "mound" or pit kiln after it is fired, as in Kenya,[89] but this is not usually the case.

5. Weight and volume of loads

Charcoal is usually sold in large burlap sacks weighing about 60 pounds each. The number of bags loaded depends on the way they are to be transported. In Cajolá, Guatemala, carboneros go to market once a week with 150 pounds of charcoal.[90] Charcoal burners produce 100 to 180 pounds of charcoal per week in Chinautla, Guatemala. Each sells about one half his output to a regular buyer in the capital city and the other half to various other buyers. The carbonero either carries the charcoal himself or transports it by bus, usually once a week.[91] In the Sudan, truckloads of 70 bags of 45 kilos each and truckloads of 400 bags of 45 kilos each are shipped to Khartoum and other cities from major charcoal production areas, usually on a daily basis during the dry season. No road transport is possible during the rainy season.[92]

6. Means and cost of transport

Transport of charcoal is accomplished by human portage, animal carriage, bicycle, and motor vehicle. Many charcoal producers walk to market carrying their charcoal output.[93] Others ride a bicycle or push a cart.[94] Animals -- burrows, oxen, horses, etc. -- are used to carry or pull charcoal to market as well.[95] Finally, trucks, cars, buses, motorcycles and nearly all other forms of ground transport, including railways, are used to take charcoal to market.[96] Water transport is also used to transport charcoal to market in some areas.[97]

The cost of transport for charcoal varies by mode as well as by area within countries. Human portage may be hired for charcoal transport. Animals used for charcoal transport are usually owned by the charcoal burner so that per trip costs are not generally reported, although they could be calculated. The best documented transport cost information is available in the case of motorized ground transport. In Malawi, a seven-ton truck costs 15 tambala (about 20 U.S. cents) per ton mile for hauling charcoal and other products.[98] In Guatemala, a bus trip to the capital to sell

charcoal costs 50 U.S. cents and the carbonero transports 45 to 90 kilos of charcoal. The 50 cents represents about 20 percent of the price the carbonero receives for 45 kilos of charcoal.[99] Moreover, those who travel by bus must pay a tax on the charcoal and may be asked for permits and receipts.[100] Trucks are used almost exclusively to transport charcoal in the Sudan. Rail could be used, but the availability of railway cars is very limited. The distance between where the charcoal is produced and consumed is so large that no other transport means is appropriate. The cost for 300 kilometers of transportation per 45 kilo bag in the Sudan (1975) was 0.15 Sudanese pounds for rail and 0.50 Sudanese pounds for truck. There was, however a 13 month delay in obtaining rail transport for charcoal. The truck rate of 0.50 (LS) accounted for 50 percent of the retail price of charcoal in Khartoum.[101]

7. Species and part of tree used

The best charcoal is made from hardwood, especially the trunks and large limbs of hardwood trees. In Guatemala, oak is the preferred species (as compared to cyprus and pine);[102] the same appears to be true in Lebanon.[103] The Acacia species are preferred in the Sudan (Acacia mellifera, Acacia seyal, Acacia nilotica, Acacia senegal, Acacia arabica) because the charcoal made from it lasts longer than that from other species. More and more Eucalyptus spp. are being used, however, because the Acacia spp. is becoming scarce.[104] Hardwood species are clearly preferred in Ghana because the charcoal they produce burns without sparking and can be made more efficiently in earthen mounds. When softwood is used, the charcoal is soft and small and only a little can be made from a given amount of wood.[105] Acacia spp. are preferred in Kenya, followed by Combretum spp. Teminalia spp. are also used, as are several others. The best quality trees, which are found in the more arid parts of Kenya, are used for construction purposes. The poorer quality trees (crooked, etc.) are used to make charcoal.[106] Softwood charcoal in Tanzania is not accepted by consumers as a substitute for hardwood charcoal. The softwood charcoal price (1978) is 50 percent of the price of the hardwood product, despite equal production costs for both.[107]

The part of the tree used to make charcoal depends somewhat upon the production technology being used. Traditional charcoal production methods use large trunks and limbs of trees; the smaller

branches are used only as packing or firing material for the larger pieces of wood because they tend to burn completely or to make small, crumbly charcoal.[108] When more sophisticated kilns are used, however, smaller branches and even twigs can be converted efficiently into charcoal.[109] In Afghanistan, scrubby brush is made into charcoal[110] and scrub oak is used in Lebanon.[111]

8. Seasonality

There is often a distinct seasonality to charcoal production activities. In Guatemala, the seasonal nature of its production turns mostly on subsistence farming activities as shown in Table 9. During the dry season when there is no work in the corn fields, every family in Chinautla, Guatemala has at least one man working as a carbonero.[112] Near Tepoztlan, Mexico, many small farmers burn charcoal in the slack farming season.[113] There is a distinct charcoal price difference in Isiolo, Kenya between the dry and rainy seasons which implies less charcoal production in the rainy season.[114] The rainy season in the Sudan does not halt charcoal production, but it does stop the transport of charcoal to major markets because the roads become impassable.[115]

9. Ecological impacts

Pressures to supply charcoal have denuded areas of even smaller trees and shrubs in numerous countries. In Nigeria, charcoal producers have used small trees and even shrubs as larger hardwood trees become scarce.[116] The forest area available for charcoal production has receded rapidly from Khartoum in the Sudan, leaving more vulnerable soil conditions behind.[117] Near Bara, young trees have been cut and the land denuded, leading to rapid deterioration of the soil.[118] In Ghana, the demand for charcoal (and firewood) is destroying the forested areas of the coastal savannah and reducing the fallow period, thus creating deteriorating land capability and some erosion problems.[119] In Guatemala, mountain areas have been reduced to bare slopes by cutting wood for charcoal.[120] Around Isiolo in Kenya, cutting trees for charcoal led to such a degree of soil erosion that it was prohibited within three miles of the town.[121] Near Mbere, Kenya, charcoal production has been ecologically damaging in recent years,[122] as is the case in other areas of the country as well.[123] Large parts of the forest land around Tepoztlan, Mexico have been denuded by charcoal burners.[124] Similar impacts have resulted from charcoal burning in Afghanistan,[125] Brazil,[126] and Iraq.[127]

Table 9 : Seasonal variability in charcoal production in the area of Quetzaltenago, Guatemala

Charcoal Price	Month	Migration Cycle	Subsistence Farming	Charcoal Prod. Frequency
$1.50	January	returning from the coast w/ corn and cash	little activity, upland harvest already completed; no planting	much production takes place; price falls
$2.50	Feb-Mar		corn planting from Feb. to early March	only few producers
	April	out-migration to plant corn for those w/ insufficient land. Migration to the coast to obtain and dry fish for Lent, which is sold in the market		overall decline in production-- A base supply is manufactured by 400-500 families who produce year-round, except in the planting season
	May		wheat sown	production decreases
	June-July			production increases slightly, rainy season
$2.00	Aug -Oct	coastal migration to harvest corn, work on coffee and corn farms. Half the 1000 families go to the coast		production decreases; minor shortages in Q. but shortages are not critical
$3.00	Nov-Dec	first two weeks of Nov. majority of highland families return from the coast	corn and wheat harvest begins	charcoal manufacture comes to a "virtual halt" Prices reach their peak in Q.

Source: Hehr, "Charcoal: Its Multifarious Effects in a Rural Guatemalan Community, pp. 55-59.

10. Changes in production and transport as a result of shortages

Several changes in charcoal production result from shortages of wood. Smaller trees of desirable species or less desirable species are used.[128] Smaller stacks are fired. Charcoal burners go farther away from their markets for charcoal or from their homes to make charcoal.[129] More disregard for official control of wood cutting or charcoal production processes occurs as in Kenya, where charcoal is made within prohibited areas at night to avoid police.[130]

Transport changes also occur as a result of shortages of wood to make charcoal. As charcoal burning areas shift further away from consuming centers, more motorized charcoal transport is required.[131] Transport costs for charcoal also tend to rise, both because of the increasing time and distance involved, but also because easy access to the charcoal produced may not be possible given the remoteness of some areas.[132] On the other hand, increasing transport distance may result in rationalizing the charcoal transport system and even in lowering per unit charcoal transport costs by making bigger loads available at one time, by enabling rail instead of truck transport to be used, etc.

D. Distribution

1. Means of allocation

Charcoal is produced mainly for cash sale, thus supply, demand and price are the major means of allocating it. In fact, charcoal tends to be a fuel for the cities and industries and for those with enough money to buy it.[133] Firewood tends to be more outside the monetary economy than charcoal in most developing countries.

a. Price

The price of charcoal in various developing countries is shown in Table 10 for years from 1966 to 1977. Two major points are illustrated by the data. First, there is substantial variation in the price of charcoal between countries and regions. Second, the price of charcoal is rising substantially everywhere unless it is regulated by the government.

Charcoal prices on an energy equivalent basis may be higher or lower than the prices of alternative fuels, depending primarily on where the charcoal is produced. Prices (in Nigerian Naira) of charcoal and other fuels on a coal equivalent energy basis are shown in Table 11 for a typical village and city in Nigeria. The charcoal is expensive because of the transport costs involved. Equivalent prices for alternative energy sources in Accra, Ghana in February, 1979 (see Table 12) show the same pattern for charcoal, but not for other fuels. Again, the reason is the long distances from Accra to charcoal burning areas. A similar comparison in the Sudan shows electricity to be the most expensive, followed by butane, charcoal, kerosene and firewood.[134] Arnold also shows charcoal to be less expensive than alternative fuels.[135]

Table 10: Charcoal prices for 13 developing countries over time
(prices are in $US/mt)

Country	Explanation	Year							
		1966	1967	1969	1970	1971	1975	1976	1977
Brazil	Delivered to consumer industry	--	--	--	22.10	--	--	--	44.80
Burma	Retail price in Rangoon	--	94.60	--	--	--	--	--	121.70
Cameroon	Retail price in Yeounde	--	--	--	--	127.00	--	--	240.00
Indonesia	Average local market price for charcoal from natural forests	--	--	--	30.10	--	--	--	90.40
Madagascar	Retail price in Tananarive	--	--	31.50	--	--	--	--	46.00
Morocco	Retail price in Casablanca	--	--	--	--	58.40	--	--	120.20
Pakistan	Retail price in Karachi	53.40	--	--	--	--	--	96.50	--
Philippines	Wholesale price for upland species	--	--	25.60	--	--	--	--	82.70
Surinam	FOB export price, 4% moisture content	--	--	--	--	--	94.00	--	104.00
Togo	Retail price in Lome	--	56.90	--	--	--	--	--	121.30
Tunisia	Retail price in Tunis	--	--	--	--	31.00	--	--	53.60
Turkey	Retail price in Istanbul	--	61.90	--	--	--	--	229.90	--
Zambia	Retail price (regulated)	--	--	--	68.00	--	--	--	61.60

Source: FAO, Forestry Product Prices, 1960-1977, pp. 13-14.

Table 11: Prices of different 1979 energy sources in the city and in the village in Nigeria
(cost per coal equivalent in Nigerian Naira)

	Village	City
Fuelwood	9.9	22
Lagidi	80	150
Charcoal	100	90
Kerosene	77-84	63-77

Source: Ay, "Fuelwood and Charcoal in the West African Forest," 1979, p. 84.

Table 12: Effective heat yield equivalencies and cost comparison by type of fuel

Type of Fuel	Quantity[a]	Cost[b]	Cost Ratios
Charcoal	1,000 kg	84p	1.00
Firewood	2,383 kg	67p	.80
Kerosene	0.425 l	11p	.13
Bottled Gas	0.297 kg	20p	.24
Electricity	3.223 kwh	19p	.23

[a]To produce 1,940 Kcal of effective energy.

[b]Accra prices, February 1979: (1) 1 bag of charcoal, 40.8 kg, ¢34. Charcoal is sold in standard cocoa bags. The weight fluctuates depending on the type of wood used to produce charcoal. Reference is often made to a 32 kg bag. Charcoal is sold by the bag rather than by weight. Consequently, the actual cost per kilogram would vary depending on the particular bag weighed. A 32 kg bag selling for ¢34 would bring the kilogram cost up to ¢1.06. The kilogram cost would be considerably higher if a pile of charcoal, sold at a kiosk, were used as a measure rather than a bag of charcoal. In February a pile weighing 340 g sold for ¢1. The kilogram cost would be nearly ¢3. (2) Firewood, 18 kg log, ¢5; (3) Kerosene, 1 gallon container (3.79 l), ¢1 at control price; (4) Bottled gas, 32 lb. cylinder (14.5 kg), ¢10; (5) Electricity, est. ave. kwh cost, 5.46 p. Electricity prices are expected to increase 30% or more in the near future, thus, making bottled gas more economical than electricity.

Source: Martin, "The Ecology and Economics of Cooking Fuels in Ghana," p. 26.

b. Other means of allocation

Charcoal is sometimes allocated between the charcoal burner and the owner of the trees as in Puerto Rico[136] and Ghana.[137] More prominent is its allocation according to long standing supplier-customer relationships. Most charcoal burners have regular wholesale or retail buyers[138] who, while they pay the market price, probably get preferential treatment as to security and quality of supplies.

2. Distributors

Charcoal distribution in market centers at wholesale and retail levels is done by men and women. Women sell charcoal in Guatemala,[139] Zambia[140] and other countries and are primary marketers of charcoal in Kenya.[141] Men also sell charcoal in Guatemala, Ghana, Zambia, and many other countries.

3. Storage

Charcoal is stored in many areas, especially for the rainy season[142] and, to some degree, as a part of the normal marketing process.[143] In the Sudan, charcoal is stored near its production site until the roads become passable again.[144] Near Sao Paulo in Brazil, charcoal produced is picked up weekly by truck.[145] Retail sellers of charcoal store their unsold charcoal as inventories.[146]

4. Villages, towns and cities

Charcoal is distributed in villages, towns and cities, with much more being distributed in towns and cities than in villages.[147] Distribution is achieved by door to door sales in areas of Guatemala, Kenya, and other countries. It is sold in central market places in the Sudan, Kenya, Zambia, Ghana, Guatemala, Kenya, and in many other developing countries.

E. Consumption

1. Consumers

The users of charcoal include homemakers, businessmen, and government officials. Homemakers presently consume the largest volume of charcoal used in most countries.[148] Businessmen, ranging from hotel keepers[149] to steel makers,[150] consume large

quantities of charcoal as well, and their demand for charcoal is expected to surpass that of households in some countries (e.g., Ghana and Brazil) in the future.[151] Various government offices and institutions also use charcoal in some countries.[152]

The vast majority of charcoal consumers are urban dwellers.[153] Most villagers use very little charcoal primarily because it is expensive relative to other fuels, especially where firewood can be gathered free.[154] In Ghana rural people use only 16 percent of the charcoal produced while urban dwellers consume 84 percent. Both rural and urban consumers in Ghana have increased their use of charcoal as a percentage of total fuel consumption.[155] A comparison of an industrialized village and a traditional village in Ghana (Table 13) has shown that the industrial village uses much more charcoal than its traditional counterpart.[156] The household consumption expenditures for fuels for all of Ghana in Table 14 show urban and large city dwellers used most of the charcoal in 1974.

2. Uses of charcoal

Charcoal is used by households primarily for family cooking and heating.[157] Homemakers also use it for ironing,[158] to make foods and other goods for commercial sale, to dry fish or meat, and for other similar uses.[159]

Businesses require charcoal for a variety of purposes. Tailors and washer people use substantial amounts of charcoal to iron clothes.[160] Hoteliers use it for space heating.[161] Blacksmiths use charcoal for heating metal in small forges[162] and it is used in cement and iron production,[163] brickmaking, ceramics and pottery firing, tile burning and drying of crops such as tobacco, tea and coffee.[164] In Mexico, charcoal is used by tallow chandlers, hat-makers and iron forgers.[165] Some restaurants in Guatemala use charcoal for cooking and barber shops use it for space heating.[166]

3. User attitudes

In comparing charcoal with other fuels, users consider several factors, including price, heating value, smoking characteristics, storability, and availability. In rural areas, less charcoal than firewood is used, primarily because of the higher price of charcoal. The price preference in favor of firewood usually

Table 13: Type of fuel used in a traditional and an industrial village in Ghana

Type of Fuel	Juapong (industrial)	Vane (traditional)
Firewood	26%	87%
Charcoal	24	0
Charcoal/Firewood	44	13
Kerosene	3	0
Charcoal/Kerosone	3	0
total	100%	100%

Source: Jean Steckle, Effects of Industrialization on Food Consumption Patterns: A Study in Two Ewe Villages, Technical Publication Services, No. 20 (Accra: Institute of Statistical, Social and Economic Research, 1972), p. 85.

Table 14: Household consumption expenditures for fuel and power, 1974

Fuel and Power	Rural	Urban	Large[a] Cities	Total
Electricity	408	2,604	5,960	8,972
Gas	136	360	816	1,312
Kerosene and other liquid fuel	20,240	5,148	2,864	28,252
Charcoal, purchased	4,076	8,876	11,396	24,348
Charcoal, imputed value of own production	1,284	272	56	1,612
Firewood, purchased	1,804	4,036	1,024	6,864
Firewood, imputed value of own produce	47,712	6,576	16	54,304
Total, fuel and power	¢75,660	¢27,872	¢22,132	¢125,664
Total, all household consumption expenditures	¢1,450,668	¢611,692	¢542,444	¢2,604,804

[a]Kumasi, Sekondi-Takoradi, Accra

Source: Government of Ghana, Central Bureau of Statistics

overrides other rural user attitudes favoring charcoal -- e.g., the fact that it does not flavor foods, its intensity of heat, ease of starting, smokelessness, etc. Also, to produce ones own charcoal is burdensome unless firewood supplies are so far from the village as to make it worthwhile. Another economic factor affecting the use of charcoal is the price of the cooking equipment needed to use it. A charcoal burning cooker (usually metal) costs money, whereas firewood can be used without incurring such an expenditure.[167]

Status affects the villagers use of charcoal too, in that its use is more prestigious than the use of firewood, primarily because it shows the villager can afford to pay for charcoal. Also, the women of such a household no longer need to engage in the task of getting wood,[168] which some find burdensome.[169] On the other hand, the social aspects of wood gathering are highly valued by some village women.[170] Wealthier families in urban areas often shift from charcoal to other fuels for reasons of convenience and status.[171] They sometimes shift back again during times when kerosene or gas is in short supply. Also, they shift to and from charcoal depending upon their geographical location and the types of fuels available there.[172]

Convenience and performance are important aspects of the use of charcoal favored by those who cook mostly with wood. Village women like to use charcoal because it heats foods much faster than wood.[173] Some complain that the firewood they use to cook flavors their food.[174] Others need the smoke provided by the wood (but not by charcoal) to repel insects.[175] Pure personal preference also influences the villager in selecting charcoal over other types of fuel.[176]

Specific kinds of charcoal are preferred for specific tasks. As Ay reports, "charcoal has very specific uses, and ... specific quality requirements ... have to be met ...."[177] In Ibadan, Nigeria hardwood that is slow burning and non-sparking is used for domestic space heating. Nigerian tailors and washermen heating irons with charcoal require a hard charcoal that burns a long time with constant heat.[178]

Urban dwellers are often constrained from using firewood because of its associated fire hazards and air pollution problems. Also firewood storage in the city is more difficult than charcoal storage.[179] Many, however, mix their use of firewood and charcoal, with charcoal being used for smaller stoves and to cook smaller quantities of food.[180]

User attitudes regarding the impacts of charcoal production upon their environment and economic livelihood vary, depending upon how each user is affected. Those needing charcoal, expect their supply and tend to overlook the social and economic costs of charcoal production for others. Thus, in Agomeda, 58 km from Accra in Ghana, villagers find charcoal producers cutting trees near their homes to make charcoal for consumers in Accra.[181] At a time when more and more Ghanaian industry is shifting to charcoal to save foreign exchange, thus helping bring about an anticipated tripling in the demand for charcoal in Ghana during the next 13 years, the major savannah species preferred for charcoal is becoming scarce.[182] In Tepoztlan, Mexico the charcoal producers and those favoring conservation of the rapidly disappearing forests (due to charcoal production) were at odds with each other as to how to proceed in the future in using their forest resources.[183]

F. Discussion

1. Place of charcoal in community fuelwood programs

Charcoal has special characteristics as a fuel that suit it to main requirements in the home and in small and some large scale industries. It is easy to start, rapidly delivers a concentrated and steady heat with little smoke or flame, and is convenient to transport and store. These characteristics are preferred by rural and urban households and businesses for many uses. It is also a more efficient fuel than firewood and can be economically obtained from further away.

In some cases, a charcoal based community fuelwood program could build on these characteristics. This is especially true if land near the community is scarce and needed for agriculture, if fuelwood scarcity is likely to commercialize the rural firewood sector and lead to conversion to charcoal so that paying for charcoal is not unusual, and if rural-urban competition for wood is likely in the future.

2. Rural-urban benefits and conflicts from charcoal production

Charcoal, at present, is the urban, commercialized, industrial fuel that draws upon a rural resource base. As such it is quite different from firewood; it is mostly produced by rural people, but seldom consumed by them. It is a cash crop, mostly to earn revenues for the rural poor. Its costs are usually social

(not paid directly by the charcoal producers) ones, borne by the entire community and sometimes, but not always, by urban dwellers as well. All rural people, then, tend to pay for the charcoal consumption (ecological problems, more time spent gathering firewood, underpayment for charcoal labor sold to the urban elite, etc.) of the nearby urban and industrial populations, while only a few rural people benefit directly.

Charcoal production may enable cottage and other local industrial activities that directly benefit rural people, but it is far more likely to enable urban industrial activities that benefit rural people much less directly, if at all. For rural households to benefit directly from this production, they must be able to buy it, and at favorable prices in comparison to other fuels, especially firewood. Neither possibility is likely in most rural communities in developing countries. Or, they must be able to sell it to the urban sector at prices that capture the social costs they incur in producing it. Both of these possibilities should be carefully considered in developing a community fuelwood program with a charcoal component.

Charcoal, as an increasingly important renewable fuel source, is likely to be in short supply in many more rural-urban areas in developing countries than at present. Such pressures will impact detrimentally on charcoal wood resources and the environment, rural communities, and the rural and urban poor. Rural-urban conflicts will intensify. Effective control of access to charcoal wood will be increasingly difficult to maintain in some areas. The local politics of firewood and charcoal production and distribution will become more important too. Community fuelwood programs will operate right in the middle of these various forces and to be successful, must account satisfactorily for the effects of all of them and others like them. Thus, wherever urban charcoal requirements are important, a community fuelwood program must deal with them as well as the needs of the rural community. In some cases, the rural community may be able to develop charcoal projects for the urban sector that internalize and pass along its social costs while also providing rural employment and better preserving the natural environment.

3. Conflicts within the rural community due to charcoal production

Whereas firewood collection tends to involve every household in a rural community, charcoal production involves a few specialized

producers and some seasonal or part-time producers. Put simply, a project that deals with firewood goes from tree to end user, while one that deals with charcoal goes from tree to charcoal producer to end user. Therefore, any community fuelwood program that builds in a charcoal production component will be benefitting a specialized few in the rural community as well as the urban community. This may be significant in terms of community participation, particularly where there is competition between the firewood needs of the rural people and the wood needs of their neighbors who are charcoal producers (and who may have a low status in the community). The community fuelwood program emphasizing charcoal may be viewed by most rural residents as an effort that aids only a few rural charcoal producers and urban charcoal consumers. Shortages of firewood in the project area will worsen the problem. This potential conflict between the interests of those in the rural community has to be considered in the design of a community fuelwood program with a charcoal component.

4. Women

Women are not the predominant charcoal producers in rural communities, but they do play a very important support role for the men who are. They like charcoal better than firewood for several uses and for several reasons. Most rural women, however, do not buy charcoal; they cannot afford it, even though it lightens their burden considerably in terms of cooking, ironing, gathering firewood, etc. From the point of view of most rural women, community fuelwood programs that make charcoal available to them would be entirely welcome. The trick is to develop charcoal program components of community fuelwood programs that meet necessary economic criteria and can still provide charcoal to the village woman at prices her household can afford and will pay in light of other fuel alternatives.

5. Conservation and technology

Conservation and use of all available wood resources for energy is becoming very important in many rural areas and for entire countries. Charcoal programs can economically convert wood wastes from remote areas into useable energy for rural and urban people.

Some such efforts may qualify as "community" fuelwood programs, and all would contribute to much the same overall objective.

The technology of charcoal production is a major issue in conserving wood energy and in developing charcoal production programs. Current practices provide only 8-12 percent of the energy of the original wood as energy in charcoal. New kilns can increase this to 20-25 percent. Such kilns are very expensive from the point of view of a rural charcoal producer or even a community. They may also be large, stationary, more difficult to operate effectively, and require a labor force. Mobile kilns overcome some, but not all of these problems. Cooperative kilns have been tried, but were not very successful. Government production of charcoal has not been very widespread or successful either. This leaves private entrepreneurs to finance and operate these more efficient charcoal technologies. Their use now seems beyond the reach of the bulk of rural charcoal producers, but community fuelwood programs should still seek to bring the best of the emerging technology under the control of the rural areas.

6. Government involvement in charcoal production

The literature indicates that very few governments on any level are directly involved in charcoal production in developing countries; they are directly involved in timber and firewood production. This may lead to biases toward firewood in considering community fuelwood programs. It surely indicates that rural people are the major source of knowledge and expertise regarding charcoal production, not their governments.

7. Control of access

Where charcoal production is important and wood resources are diminishing in the rural area, control of access to existing wood supplies becomes even more important. Little in the way of regulation of access actually works very well anywhere, however, unless inordinate resources are committed to controlling access. Private lands, centrally located lands so that any poaching can be easily spotted, and complete participation by the community in trying to control access to the wood resources tend to be the best means. Even these only work, however, if people can meet their firewood and charcoal needs without breaking the rules.

8. Seasonality

Seasonality of charcoal production is obvious in many countries and areas. Generally, though, it is not as pronounced

as in the case of firewood. Many charcoal burners specialize in producing charcoal and operate year-round. Urban charcoal consumers, particularly, burn charcoal the year round. This may make the charcoal component of a community fuelwood program easier to design.

IV. COMMUNITY FUELWOOD PROGRAMS

A. Introduction

This chapter focuses on community fuelwood programs -- the responses rural people have made in attempting to supply more of their own fuelwood needs. It reviews the way in which issues of land allocation and use, production, harvesting, transport, distribution and consumption of fuelwood have been dealt with in different communities. Brief descriptions of selected community fuelwood programs, as drawn from the literature, are presented in Annex 6 . These descriptions provide an overview snapshot of individual programs. The remainder of this chapter explores seriatim the above mentioned aspects of various community fuelwood programs.

B. Reasons for Programs

Very few community fuelwood programs exist per se, that is, as efforts solely to supply fuelwood. In most cases, fuelwood production efforts have come about in response to national or local shortages of fuelwood.[1] In general, the basic aim of community fuelwood programs is to provide additional supplies of firewood or charcoal for domestic households and local cottage industries. However, fuelwood is only one end result of tree growing. There are many other desired products and results, and obtaining them is also a main reason for initiating community fuelwood programs. Such results include timber production, land use management and water conservation, erosion control, land beautification, recreation, animal grazing, fruit, nut, bark, spice and gum production, and habitat for animals, birds and insects, among others.

As is described for a location in the Andes,

> The first introduction of eucalyptus is attributed to Padre Guzman, who is said to have brought them in between 1875 and 1880. At present, this tree is by far the most common in Muquiyauyo and in the rest of the valley. Its wood is employed in the construction of houses, implements, and furniture, and is used for firewood. It is recognized as not being the best wood for construction, but is fast-growing and consequently the most available as

> well as the cheapest. It is also important because of the shade it affords, and it adds visibly to the beauty of the town. While few Muquiyauyinos are expert woodsmen, both men and women are handy with the ax. The men fell trees and the women break up the kindling wood.[2]

Often community fuelwood programs have been integrated into efforts to control erosion and other environmental effects of deforestation, to provide other forest needs such as medicines, bark or fruit as a cash crop, to preserve water, to supply timber, to control population movements, to enhance income from marginal lands, and to encourage participation in national reforms.

Ideally a community fuelwood program would also focus on other than fuelwood supply related aims, such as fuelwood conservation or the development of alternative energy forms. Some do, but most do not, at least to any significant degree. Each program will have a different set of aims, however, and a different blending of priorities for the aims; where the fuelwood production aspect of each program ranks depends on location-specific circumstances surrounding the project.

Community fuelwood programs have been established in rural areas of South Korea, India, and Niger[3] primarily to provide firewood. Some programs have been established in urban areas solely to supply fuelwood, as is the case around Lilongwe, the new capital city of Malawi.[4]

Environmental protection has been the major goal of community forestry activities in some areas with fuelwood production being a by-product of such efforts. For example, Bangladesh instituted tree-planting programs in the 1950's to involve local people in reforesting badly denuded areas.[5] The Forest Industries Organization (FIO) program in Thailand settles shifting cultivators in forest labor camps to prevent destructive land clearing and to implement planting schemes designed to increase the productivity of the tropical forest area.[6] Participants in the program obtain firewood from trees on the work site, as do workers in shelterbelt and soil erosion control projects in Nigeria.[7] Recent government legislation in Nepal, Chile, Brazil, and Colombia has called for local participation in developing managed wood lands to protect declining soil resources and for the exploitation of virgin forest areas such as the Amazon Basin to improve wood production.[8]

Senegal, Niger, Mauritania, Tanzania, and India also use community forestry programs as a means for improving marginal lands.[9]

Products such as gum arabic, honey and bark are very important or even central aspects of some forestry operations.[10]

Community forestry programs in Indonesia, Mexico, and the Philippines concentrate on furthering the development of timber operations, bringing greater income from industrial wood production.[11] The growth of these operations, it is claimed, will lead to increases in rural employment and standards of living. The energy and other needs of forest workers are provided for through assistance from the state and industrial organizations that supervise the programs.

The settlement of shifting cultivators and the organization of rural communities for forestry labor can establish and augment political control over rural areas through the stabilization of populations. This has been a significant consideration in the FIO program in Thailand.[12]

National politics play an important role in shaping community forestry programs, with village forestry projects often serving as parts of broader political and ideological reform efforts.[13] Thus, community forestry programs are a means to encourage participation in national reforms. The Chinese taungya system is the product of a larger political strategy to achieve mass participation in rural development.[14] The Village Forestry Association (VFA) program in South Korea serves to legitimize and expand community organization and control of local forest land management that has existed since private land ownership was legalized in 1910.[15] In Tanzania, village forestry is a part of the ujamaa reforms to promote greater village self-reliance.[16] India's 1952 National Forest Policy placed an emphasis on the creation of village fuel forests to provide fuelwood and small timber at non-competitive prices. The new forestry program in the state of Gujarat seeks to utilize existing cooperative organizations to work towards this goal.[17]

C. Types of Programs

As noted above, the wood production component of tree growing is usually one of several objectives of the program effort being undertaken. In fact, the multiple aims of a community forestry effort tend to dictate the structure, location, technical content and other aspects of the program, including whether it has an identifiable fuelwood component or merely produces some firewood as a by-

product. Several different production and management systems have sprung up in the developing world to achieve different aims.

Briefly, these include:

- multiproduct forestry in which the forests provide a number of other products as well as wood,
- small-scale forestry which will usually entail private or village woodlots to provide fuelwood for the community;
- arboriculture which is the combination of forestry and agricultural crops either simultaneously or alternately and which may take the form of a) agriculture interspersed with a period when valuable tree species are planted to provide a cash or other useful crop, a system which at the same time will restore the fertility of the soil for the following agriculture rotation; or b) the establishment of a forest plantation with agricultural crops permitted during the initial years; this is the well-known 'taungya' system, used extensively in many countries, under which the farmers provide free labour to clear the land and keep it weeded and in return are allowed to grow agricultural crops for two or three years after the forest crop has been planted; or c) perennial crops such as cocoa, coffee, oil palm, etc., with forest species -- this, however, is not common;
- silvipasture which covers systems in which controlled grazing of forest vegetation takes place during part of the rotation;
- integrated watershed management, which is a complex of systems and which very often will be of benefit not only to the immediate community but to all those in the low-land areas who rely on the water from above; for this reason such work will often require a strong government support and incentives if the local community participates.[18]

The last few years have seen the birth of numerous community forestry programs of these various types. For example, the growth of taungya schemes where food cropping is combined with tree production has been particularly pronounced as Thailand, Indonesia, China,

India, Bangladesh, Sri Lanka, Burma, the Philippines, Ghana, Uganda, Kenya, Mexico, and the Sudan have all instituted some form of community taungya programs.[19] Fuelwood production often is not the sole nor even the primary focus of taungya cultivation. Firewood becomes available through such operations, but the stabilization and enhancement of village fuelwood supplies is not necessarily an end product.

D. Initiators, Supporters and Managers of Programs

1. Initiators

For the most part, central and regional governments, sometimes together with international assistance organizations, have initiated community fuelwood programs. Sometimes communities have been consulted, sometimes not, depending on the reason behind the establishment of the project, as to what their recognized needs and desires from such a project would be. Usually the programs are begun by national or district government, often with the technical and monetary assistance provided by international agencies. The international agencies must of course work through the country governments, although some of the smaller non-profit or church related groups focus their efforts directly at the village level.[20]

Only scattered cases can be cited in which communities or villages initiated their own fuelwood programs. One example is particularly interesting however, because it shows that community initiated self-help forestry projects have a fairly long albeit sparse tradition.

The Muquiyauyo community in the Peruvian Andes apparently has operated organized tree planting to provide fuelwood and timber since the late nineteenth century, when eucalyptus trees were introduced to the area:

> The planting of trees has been an important activity in Muquiyauyo for many years. The valley does not have a natural tree cover, so wood for fuel and construction must be cultivated. The district session books frequently record that a committee has been appointed to see to the acquisition of trees, or

> that a work project will be held to plant some. The earliest mention is in November, 1887, when it was decided to hold a work session to plant alder trees in the alameda. The first record of the district's decision to buy eucalyptus trees was made in 1911, when four boxes were ordered from Tarma. In 1920 it was agreed to plant eucalyptus on the new alameda all the way to the base of the mountain, and in a 1924 record this project is mentioned as being underway. In 1928 it was suggested that eucalyptus should also be planted in the Isla area. Until this time it had been the practice to bring the young trees from Tarma, but in this session it was suggested to seed them in Muquiyauyo. In 1931 another three thousand trees were brought in from the town of Concepcion.[21]

In South Korea, Village Forestry Associations have sprung up spontaneously for centuries with the aim of improving fuelwood supplies. They were finally recognized by the Government in 1951. In China, central government policy mandates that the masses protect forests and trees, but many communities have successfully initiated and carried out their own fuelwood programs with assistance from local revolutionary committees.[22]

Much of the initiative for community fuelwood projects in Western Nigeria came from the communities themselves.[23] In Kenya, the elders of the Gabra people requested help in afforesting the Hurri Hills and in enhancing water and grazing for their livestock there.[24] In Thailand and India, a kind of community initiated fuelwood program has sprung up, utilizing traditional institutions to effectively manage existing common land for fuelwood production.[25]

During the late 1920's in Tepotzlan, Mexico, the villagers organized the first forestry cooperative in Morelos state and large-scale production of charcoal began again.

> The sharp decline after 1934 reflects the falling off in production following the killing of the forestry cooperative leader, Juan Hidalgo. Slowly, production increased until 1937, when the cooperative was disbanded. Since that time there has been a marked diminution in production.[26]

Only a few cases can be noted in which a community had a significant input into the design and implementation of programs authorized by the government. The literature is repleat, however, with examples of community fuelwood programs designed with little or no community participation or initiative. Special emphasis on incentives to ensure community support and involvement, while always necessary in community based development efforts, is particularly noticeable in such efforts. Some project papers subtly highlight the lack of early community involvement and initiative by noting that "opposition to the project is unforeseen.... No one is threatened by planning basic natural resources...."[27] In Gujarat, India, however, the village leaders were consulted on village woodlot proposals by members of the Forestry Department; similar consultations at the planning stage between government employees or donor agencies and village members have gone on in Niger, Upper Volta, Mauritania, Chad, Senegal and other countries.[27a] In such cases, while the community did not initiate the program, it was at least an active discussant in its early stages, albeit often without any practical authority.

In contrast to the few cases cited above where communities have initiated fuelwood programs, there are many examples of how various levels of government have initiated them with little or no grass roots consultation with the target groups. Ecuador's Social Afforestation law requires owners of lands suitable for forestry to afforest such lands or to turn them over to the government so that it can afforest them.[28] In Colombia, an integrated rural development program grants private land holders credit and provides research, extension, surveys and demonstration plots to help spur their interest in establishing small forestry components on their farms.[29] The Indian National Commission on Agriculture is promoting community forestry programs to meet local fuelwood needs.[30] The state government in Gujarat already has begun such a program as was previously indicated.[31]

In Indonesia, the State Forest Corporation (SFC) initiated and runs the community development program that establishes red kaliandra as fuelwood.[32] Panchayats at the local, district, zonal and national level initiated a pilot rural development project in Nepal that includes reforestation of government land to provide fuelwood and forage.[33] The Forest Industries Organization of Thailand initiated the forest village system to curb shifting agriculture and effect reforestation.[34]

National governments have initiated programs in Upper Volta, The Gambia, and Senegal.[35] The Tiro forestry project in Ethiopia was initiated by the State Forest Development Agency (FWDA).[36] The "shamba" system in Kenya was initiated by the Kenya Forest Department.[37]

A village reforestation project for five villages of the Thies and Sine-Saloum Regions of Senegal was initiated by the Senegal Forestry Service.[38] Regional and local governments have also initiated programs in some areas.

A tree nursery and small scale integrated rural development project emphasizing tree planting for fuelwood production in Ouahigouya, Upper Volta was initiated by the regional development organization of the Yatenga District.[39] The direction from Gujarat State Government has been central to the success of the village forestry program.[40]

Local or international financial and technical assistance donors are major initiators of community fuelwood projects. CARE, Peace Corps, Catholic Relief Service, and Africare have been actively involved in small-scale woodlot and fuelwood plantation projects in Niger, Upper Volta, Mauritania, Chad, and Senegal.[41] The International Development Research Centre is supporting community planned and implemented forestry programs in Senegal and Niger.[42] Aid from the World Food Program has been used by the Turkish government to establish forest villages without any commitments to the commercial exploitation of forest resources.[43] In a collaborative support effort, the Kenyan government, several Roman Catholic and Protestant missions, the National Christian Council of Kenya, and the UNESCO/UNEP Integrated Project in Arid Lands jointly sponsor a cooperative forestry for local community development effort.[44] The Arusha Synod of the Evangelical Lutheran church of Tanzania has initiated fuelwood efforts for the villagers of Lemongo, Minjingu, and Sale.[45] Amednagar College in Maharashtra, India has initiated an afforestation project for six villages which, although it did not achieve its planting target, has been an "unqualified" success, especially as compared to nearby government efforts.[46]

Multilateral and bilateral donor agencies are becoming more involved in actually initiating community fuelwood programs, although this is done through national governments. The FAO has been the most active in exploring and encouraging such programs as witnessed by its many papers and conferences on the subject included in this report.[47] The Philippine Development Bank and the World Bank have joined forces to fund community level forestry work to improve local firewood and industrial wood production.[48] The World Bank is increasing its activity in this area of development assistance, encouraging small-scale, community-run forestry programs.[49] The Royal Tropical Institute of Amsterdam has set up a research center for agroforestry development in northern Thailand.[50] The Commonwealth Forestry Institute in Oxford, England is actively involved in many efforts of community fuelwood projects,[51] and the Beijer Institute in Sweden is an active participant as well. These are only a few of the outside donors expressing interest in community forestry programs. USAID, IDRC of Canada and other bilateral donors are becoming more heavily involved in initiating such programs as well.[52]

2. Supporters

The major supporter of community fuelwood programs, and by far the most important, is the central or national government. A strong durable commitment to such efforts by the national government has been a critical ingredient to their success in Korea, India and China. Lack of such support has been a major contributor to the failure of community fuelwood programs.[53] Of course, the support of regional or local government is very important as well,[54] particularly in order to ensure community participation in the project.

The other primary support group for community fuelwood programs is composed of multilateral and bilateral financial and technical assistance donors. These include the multilateral banks, USAID, CIDA, SIDA, etc., and private agencies such as Africare, Oxfam, Mennonite Central Committee and others.

The type of support provided communities by these various institutions is wide ranging -- funding, land allocation, technical assistance (advisory, training, research, management, etc.), materials and equipment, information, appropriate policies, etc. The most critical support components for the success of a project seem to be nurseries, extension services, research and training,[55] although many others are important as well in the specific context of each program. Whatever the unique components of the support effort determined to be central, they will be critical to the success of the community fuelwood venture.

3. Management

The management of community fuelwood programs is heavily vested in agencies of central governments; regional and local governments (District government, village councils, etc.) also play a major management role. In some cases, however, elected groups at the village level receive much of the authority and management responsibility for community fuelwood programs.

In Indonesia, all activities in the community forest program in East and Central Java are controlled, organized and take place on state owned[56] forest land managed by the State Forest Corporation. The village afforestation project in the Dodoma District of Tanzania is controlled jointly by the District Commissioner or Party District Secretary and the District Development Director. All of the land is state owned and the Forest Department provides technical advice, extension, nurseries and transport for seedlings. The community provides the labor.[57] Similar forms of central, regional

or local governmental control of community fuelwood programs exist in Columbia,[58] Kenya,[59] Senegal,[60] Upper Volta,[61] and many other countries.

Villagers themselves, as opposed to central governments or even village councils, have responsibility for fuelwood programs in the Tiro project in Ethiopia,[62] the village forestry programs in South Korea[63] China, [64] Western Nigeria,[65] Maharashtra, India,[66] and the Shinyanga region in Tanzania.[67] In Ethiopia, peasant associations elected from the participating villagers control forest areas of less than 80 hectares although the State Forest Development Agency continues to provide overall management. In Korea, Village Forestry Associations (VFA), composed of one member of each household and led by an elected member provide local leadership for the village program. Although there is some governmental coercion to participate -- VFA membership is mandatory -- the VFAs are non-governmental in a formal sense and serve to link the government to the villages.

China's program depends upon heavy individual participation mobilized by local revolutionary committees. In Western Nigeria, local communities took substantial initiative in developing their fuelwood program; the Forest Department, as a result, concentrated mostly on extension and disseminating information on the project via radio and television. The Maharashtra villagers in India all made their own land available for the common project and obtained a tree mortality rate of only one to two percent, as compared to the adjoining government afforestation program where the mortality rate reached 99 percent. As a result of the demonstration effect of the project, additional efforts are being undertaken in other villages. (Annex 6 provides additional details). The Shinyanga region project in Tanzania involves helping school children plant and care for trees. Each child cares for several trees on a three acre plot; competitions are held between schools to see who has the best trees. In this way a high degree of interest and participation has been achieved on the part of the local children.[68]

E. Land Use

1. Type of land

The type of land used for community fuelwood programs tends to be the most marginal land in an area. It is less fertile, hilly, eroded, badly situated for agricultural uses, or otherwise unsuitable for more intensive and valuable exploitation. Better land is used for growing crops, fodder and other higher value products. There are exceptions to this, especially where trees serve to halt desertification or to provide byproducts such as bark, fodder, oil, etc.

In Kenya, for example, the Hurri Hills project is to plant trees on denuded hill tops good for little but grazing and wood production.[69] In Senegal, trees are to be planted around eroded watering points.[70] Roadsides, canal and river banks and similar areas are also planted to trees. It is estimated that 39 to 60 million hectares of new forest have been created from such lands in China over the past 25 years.[71] The Chinese call this utilization of new land area for tree planting "four-around" forestry. The Republic of Korea program seeks to cover with trees as much land as possible that is not being farmed.[72] The Gujarat state in India, too, has started tree growing for fuelwood along roads and canal banks.[73]

Most land now used for community fuelwood programs was used previously for extensive indigenous fuelwood production. For example, the APROFON (Aprove-chemientos Forestales de Nayarit) program in Mexico's Sierra Madre region utilizes old-growth timber for fuelwood and other purposes.[74] The forest village system of Thailand is using taungya cultivation to reforest areas previously degraded by over-exploitation or shifting cultivation.[75] The Tiro project in Ethiopia seeks similar reforestation results.[76]

2. Location of land

Fuelwood lands are usually established near villages and other major areas of demand. Most community fuelwood programs specify which lands should be used for fuelwood production; lack of regulation of this sort invariably leads to environmental problems. For example, reforestation efforts in Bangladesh foundered when participants, given no regulations on planting site selection, grew trees next to their homes with no regard to the nature of soils and area ecology. The seedling did poorly and the woodlots were neglected and unproductive.[77]

3. Amount of land

The land area involved in community fuelwood programs tends to be small, both in the absolute sense and relative to the total fuelwood requirements of the community benefiting from the program (with the notable exceptions of the China and Korea programs). For example, while the Nigerian government aims at covering 10,000 hectares of reserved forest each year through tree planting, this amount represents just a small step towards meeting the fuelwood demands of the nation's rural communities.[78] On a project basis, successful community fuelwood efforts tend to start and remain small (even though the overall program may grow). Thus, in Tanzania each school takes on no more than three acres for tree planting.

The successful Maharashtra, India program with six villages, while planned for 238 acres, reached only 49 acres. The Tiro, Ethiopia project began with a few one hectare blocks. Efforts on such a small scale, while perhaps necessary to attain success, will not meet the expected fuelwood needs of the areas involved in the future.

4. Tenure chosen and control of land

Private, communal and government lands are used for community forestry programs in different nations. The VFA program in Korea focuses on fuelwood production from privately-owned lands. Under its provisions, the land owner must reforest suitable lands himself or turn them over to VFA management in exchange for one-tenth of the future proceeds from their use. Most owners select the latter course, as most of the lands involved yielded no income in the past.[79] Under Ecuadorian law, private land owners may afforest their holdings, but it is preferred that they turn over these lands to local community management. If neither of these options is chosen, the Forest Service will take on the work in exchange for 70 percent of what the land yields. Land ownership remains with the private individual, although arrangements to share products can be worked out with laborers.[80]

Communal land tenure is used in programs in other nations. Nepal entrusts village panchayats (local governing bodies) with the management of local forest resources.[81] Local revolutionary committees control both land use and community forestry activity in China.[82]

In the FIO forest village effort of Thailand, individual families are allotted 1.6 hectare plots for taungya cultivation in forest areas, but the trees remain state property. Villagers attain title to their land when their village reaches 30 families in size, but they may not sell or lease these lands or their wood products.[83] Other community forestry activity in northern Thailand is carried out on government lands, with local residents gaining no tenure rights at all.[84] All forestry work in Indonesia is carried out on land owned by Perum Perhutani, the State Forestry Corporation, with local shifting cultivators placed in forest labor camps to facilitate the organization of fuelwood and timber production.[85]

5. Organization and process of land reallocation to fuelwood use

The organization and implementation of land reallocation for community forestry programs is primarily a central government operation. Only in rare cases are local bodies consulted in this process although they sometimes are, and in at least one case land allocation was clearly the decision of the villagers involved with no governmental involvement at all.[86]

The Royal Forest Department surveys and classifies lands in northern Thailand under "optimum use" categories depending on slope, soil type, and other conditions. A "sufficient amount" is put aside for immediate agricultural and fuelwood needs, and the remaining lands are developed as industrial protection forests.[87] At no stage are local residents involved in land use planning, nor are they consulted about allocation.

Denying community participation in fuelwood land use planning can have disastrous results for fuelwood programs. The Colombian Caqueta project to settle families in tropical high forests and establish a 420,000 hectare fuelwood and forest products reserve failed when the settlers, angry at not being allowed to choose their agricultural sites, forcibly occupied the proposed reserve area and prevented its exploitation.[88]

The failure of the APROFON fuelwood and timber production program in the Sierra Madre of Mexico is attributable, at least in part, to the failure to involve local ejidos (district governing bodies) in the planning of land use allocation. While APROFON owned area forest lands, it did not own access rights to adjacent lands that supported these forests. APROFON planned on obtaining these rights from the ejidos in exchange for technical and economic assistance. The ejidos leaders, complaining that they had not been consulted up to this point in the program development, hesitated to grant these rights, and the program foundered.[89] Consultation with community groups does occur in some of the newer and proposed fuelwood programs.

In the Republic of Korea government officials meet with members of the local Village Forestry Associations to calculate community fuelwood requirements and to identify suitable land to be allocated for fuelwood production. Land owners are obliged to comply with the group's decision.[90] While this provides for a greater community voice in land use regulation and planning, critics of the Korean program argue that its success is more a result of government heavy-handed control than of an outpouring of community spirit.[91]

The Indian social forestry program is attempting to utilize local panchayats in managing community forestry programs, but all land use planning is done by the central government. It conducts land surveys to determine physical potential for tree-growing and community needs. Even in Gujarat, where community forestry has been the most successful and extensive, the State Forestry Organization, on its own, designed and imposed the allocation of land for village woodlots and the placement of landless families on woodlots to serve as guards and managers.[92]

Eckholm notes that woodlot development in Gujarat through social forestry has led to neither self-sustaining community involvement nor the transformation of political and social relations that community forestry in theory can entail.[93]

The Ethiopian Land Reform Proclamation of 1975 nationalized all rural lands. Peasant associations were formed in each village to implement the proclamation. At present, the Forestry and Wildlife Development Authority (FWDA) is seeking to utilize the peasant associations to assist in the design and implementation of reforestation and community forestry programs. Earlier FWDA forestry programs had been oriented towards the development of government run, large-scale, high-technology wood plantations. Local communities showed considerable hostility to such schemes, and FWDA decided to reassess its strategy. The new forestry policy, devised through collaboration with peasant association representatives, stresses the development of village self-reliance in producing unprocessed wood for fuel, building, and fencing from small-scale woodlots. At least one of the projects begun under this new land use planning strategy (Tiro village) is showing promising results.[94]

The proposed Nepal community forestry program (funded by the World Bank) is designed to ensure community participation in site selection and land use planning. Village panchayats will contribute to the design of local programs, with technical advice and training provided by a Chief District Officer from the Forestry Department.[95]

6. Special problems

Resettlement programs and other forms of land reallocation for community forestry development can result, if not closely regulated, in an inequitable re-distribution of land favoring wealthier individuals and groups. Such appears to have been the case in East Kalimantan, Indonesia, where the relatively wealthy Dayak tribe was placed in a far more favorable physical environment than were land hungry, poorer shifting cultivators. The Dayaks were also allowed to participate in resettlement site selection, while the other tribes were not.[96]

F. Production of Fuelwood

1. Organization of major actors

By necessity, a high degree of cooperation is involved between all the participants in a successful community fuelwood program. First, the villagers must cooperate with each other. If enough deviant or self-serving behavior exists within the community, it can destroy the program. Such behavior results when some community

members lose more from land reallocation or are expecting to gain too little, or less than others from the program.[97] Incentives or punishments will sometimes be required to effect the necessary cooperation. Such cooperation is usually achieved by the active involvement of local leadership in the program -- the panchayat, village elders, church leaders, etc. Together with higher levels of authority, such as Forestry Department officials, they can usually bring about the cooperation needed between villagers.

Cooperation between villagers and the government is also necessary. Usually, the members of the community supply some of the needed elements of the program and the government supplies others. A donor may also assist. If villagers do not participate in developing the project, such cooperation may not be achieved for the same reasons deviant behavior occurs among individual community members. Numerous cases exist in which fuelwood programs have failed because the community was not involved in the planning of the project. Perhaps the best known example is provided by the demise of a World Bank-financed program in Niger. The program called for the development of 500 hectare village woodlots, but none were successfully established because, as fast as the trees were planted, villagers either pulled them out of the ground or allowed uncontrolled grazing to destroy the seedlings.[98] Spears noted that the origin of this local hostility lay in the fact that villagers had not been involved to any extent in the formulation of the project, so they perceived the proposed protected village woodlot area as an attempt to deny them access to traditional grazing grounds.

In contrast, 160 hectares of village woodlots near 70 villages have been successfully established in the Matameye and Magaria districts of the Zinder region of Niger through an IDRC-sponsored project that involved the local communities in its planning and management.[99]

Means of achieving local participation and cooperation vary. Local Village Forestry Associations seem to be an important factor in South Korea. Coalitions of government and local VFA representatives established fuelwood plantations for some 11,000 villages in the Republic of Korea. Well-trained government extension officers contribute technical expertise to site selection, production and distribution of seedlings, and supervise fuelwood nurturance; government subsidies pay for needed seed and fertilizer. Each VFA provides voluntary village labor (from woodlot land owners and other available labor) to manage the woodlots and it calculates community fuelwood targets to be met through fuelwood production.[100]

In Ethiopia, community members are organized into Peasant Associations (PAs) which help achieve the necessary cooperation and program inputs.

Some 2,500 local residents (out of a total population of 14,000) took part in the planning and implementation of the joint FWDA/ Peasant Association forestry project in Tiro. Fourteen Peasant Associations were consulted in the planning of village forestry efforts. Extensive analyses were then made of land and labor availability, of local needs, and of available technologies. Each Peasant Association elected up to three members to receive forestry training and to become supervisors of their village program. PAs contribute land, labor and community organization; the government contributes technology, seedlings, training, transportation and tools. The PAs receive all the primary benefits, while the State benefits from the environmental improvements.[101]

In India's Gujurat state, the forestry department initially depended upon the demonstration effect of fuelwood plantations it had established along roads and canal banks and upon tree seedlings and advice it provided to encourage villagers to plant trees for fuelwood. It also aided large landholders in integrating Eucalyptus cultivation with agriculture. The department is now turning to village panchayats, trying to persuade them to set aside four hectare plots for village woodlots, for which the department will supply seedlings. Gujurat is one of the least tree covered regions in India, but its relatively high literacy rate (36 percent), an efficient state government organization, and a tradition of successful cooperative movements endow it with valuable support for the forestry department's efforts.[102]

The proposed Rural Afforestation Program for the hills of Nepal will rely on village panchayat participation in the selection of woodlot sites and in the provision of labor for woodlot maintenance. Local schools are assisting in the promotion of the program, and the government will establish a special Village Forestry Authority to coordinate local and national participation in the program.[103]

Extension work is a major influence in organizing communities to develop fuelwood programs. In Labgar, Senegal, the government provides an extension agent to promote community fuelwood development. The agent lives in the region and is familiar with its particular needs. In addition, a woman extension agent is used to increase community participation. Villagers contribute labor for tree planting; the government officer contributes technical expertise and coordination of local efforts. Villagers also participate in the calculation of fuelwood needs.[104] In Lesotho, extension by example was found to be the best means through which the promotion of community fuelwood programs sponsored by the World Food Programme could be publicized.[105]

2. Species

Eucalyptus species have been universally popular for community

fuelwood programs because they are quick-growing and thrive in a wide variety of soils, climates, and elevations. The late Emperor Haile Selassie of Ethiopia supported Eucalyptus plantations near the capital, Addis Ababa, early in this century to help solve the fuelwood shortage.[106] They do have drawbacks, however, as some species poison the soil and are not beneficial to adjacent food crops. The wood is of poor industrial quality; it is suitable for local needs for poles, etc.

Much attention has been paid recently to less common species, such as Leucaena (or Ipil-Ipil, as it is known in the Philippines) which has multiple uses. Introduced from South America by early Spanish priests, the tree has a remarkable growth rate and high heating value. It is also a high protein livestock feed, although some species have a slight toxicity that causes animals to lose their hair if fed too much. It is being experimented with in many countries. An International Conference on Ipil-Ipil Research was sponsored in the Philippines by USAID in 1978 to coordinate research results.

In India and other countries the neem tree (Azadirachta indica, Juss.) appears to be very promising, as is the Prosopis juliflora (mesquite), called "the precocious child of the plant world" by one of India's State directors of forestry activities.[107]

Many foresters have by now overcome what used to be a strong preference for exotics and a distaste for indigenous species, as it becomes clear that local species -- or improved indigenous species -- are often more effective in meeting local needs. For example, although Ipil-Ipil is native to El Salvador, teak and other exotic species were promoted by the forestry department until a recent decision was made to develop the potential of this indigenous species.[108]

The Republic of Korea's VFA program utilizes a mixture of species in its woodlots, including types such as Lespedeza, which, it is claimed, will yield wood product in the first year, interspersed with species that produce fuelwood and timber over a longer period.[109] A wide range of species have been tried in the IDRC woodlot program in Niger, but only neem has proved well adapted to environmental conditions. This species also has the advantage of coppicing well after exploitation.[110]

Some community fuelwood programs allow local villagers to participate in species selection. Villagers select tree species to meet firewood preferences and other needs in the Labgar, Senegal program.[111] In the proposed community forestry program for the hills of Nepal, local panchayats are to participate in choosing the species to be grown.[112] In one case, the selection of species by villagers created

problems. In the Bangladesh government sponsored wood-plantation program, the growers were allowed to select their own species and planting sites, often resulting in inattention to regional requirements and constraints. Many selections proved ecologically unsuitable; quick yielding types such as pineapple and banana were planted near homes without regard to the nature of the terrain or the location of the markets. Soil fertility suffered while the fast yielding types failed to flourish in existing conditions. Wood shortages became an even greater problem.[113]

Other community fuelwood programs utilize government-chosen species, but distribute seedlings free to all who wish to plant trees. In Tiro, Ethiopia, 90,000 seedlings (90 percent Eucalyptus) were distributed and planted over 23 hectares in the territories of 14 Peasant Associations in this manner.[114] The Gujarat forestry department, which provides seedlings of selected species for those people wishing to plant trees, has also achieved similar successes.[115]

3. Methods of production and management

Community involvement in the implementation and management of fuelwood production is necessary in practical terms and as a means of assuring the success of community fuelwood programs. Villagers schedule their time and labor with the local forester in the Labgar, Senegal program. They work to prepare the seeds before planting season; at the outset of the first rains, livestock herders also join in planting trees. Women carry water to support local men's work on the woodlots.[116] Tiro, Ethiopia Peasant Associations are in charge of land clearing for tree planting operations. They select and clear lands using both their own tools and those supplied by FWDA.[117] In Niger community fuelwood work, women provide food and support while men plant trees in community woodlots.[118]

The forestry department in Gujarat pays villagers from poorer settlements to carry out soil preparation and tree planting. They are responsible for protecting stands from unauthorized grazing and for stopping cutting on community woodlots. In 1978, after four years of project operation, 3,000 of 18,000 area villages had established woodlots. Fodder grasses and fruit trees also have been cultivated in woodlots to achieve quick returns while waiting for fuelwood seedlings to mature.[119]

The Gujarat forestry department now proposes to settle landless families on 2.5 hectare plots and charge them with protecting seedlings planted there until they reach maturity. Each year such families would be assigned a new area to protect until the harvest, in 10 years time, of the first wood crop.[120]

In the proposed community fuelwood program in Nepal, village panchayats are to participate in defining management objectives. The program will contain a second focus on fodder production, and the panchayats will assist in devising guidelines for the intercropping of fodder crops with young trees and the integration of grazing and forestry management in older plantations.[121]

4. Backup support systems

Nursery, training, and extension activities are integral to the success of community forestry programs. Unfortunately, most national forestry departments cannot run these operations on a large-scale due to shortages of qualified personnel, the absence of forester training in community level work, and the lack of sufficient authority to legislate and implement land management and fuelwood production objectives through the agency of its field staff. In Tanzania, for example, the total government forestry staff of 22 is not able to achieve the village fuelwood development objectives outlined in the ujamaa reforms.[122] An FAO study in Senegal estimated that a minimum 800 forestry technicians would be needed to carry out planned forestry programs in 1980. As of 1977, they had only 260.[123]

The Korean Village Fuelwood Plantation program, on the other hand, owes much of its success to the institutional reforms and extension support that accompanied its development. In addition to legitimizing authority of existing Village Forestry Associations and requiring that such organizations be formed for every village, the Office of Forestry was placed under the Ministry of Home Affairs, strengthening its authority and its ability to enforce forest management regulations. The status of provincial and county forestry affairs was raised and their staffs increased. A strong extension and publicity campaign has been mounted to promote the program's aims and to provide technical expertise for site selection, to organize production and distribution of seedlings, and to distribute government subsidies to meet woodlot establishment and maintenance costs.[124]

Other examples of constructive support systems can be found in a few community fuelwood programs. The SODEVA program in Senegal encourages the creation of backyard nurseries to provide seedlings for woodlot and reforestation projects. Village women grow the seedlings and sell them locally.[125] The Labgar program in Senegal now employs a woman extension agent to assist in increasing total community participation in fuelwood development.[126] In the Tiro program in Ethiopia, one to three members of each Peasant Association are selected to receive FWDA training. They spend three days at a FWDA nursery studying planting techniques, supervised by foresters specifically assigned to this task.[127]

As an international assistance agency, FAO has put together a forestry training seminar to educate local forestry personnel in all aspects of forestry from species selection, tree planting, tending and harvesting, as well as the social concerns of community forestry. Thirty Senegalese will participate in the training and then go to the field to draft a proposal for a project to be implemented. This seminar will be sent to other countries at their request.[128]

The forestry department in Nepal plans to build up its extension services in preparation for the implementation of proposed community fuelwood programs. It will develop a special extension department within the Ministry of Forestry, called the Village Forestry Authority. Progressive farmers will be recruited locally and provided with short, on the spot, training in nursery and planting methods.[129]

5. Economics

Small-scale village woodlots can in many cases provide a cheaper and more effective means for meeting community fuelwood needs. In the Tirò program in Ethiopia, it is estimated to have cost $66 (US, 1978) per hectare to establish community woodlots in the territories of some 14 Peasant Associations. FWDA had previously tried to establish large-scale commercial fuelwood plantations to meet energy and environmental development objectives. The cost for these projects was an estimated $400-1250 per hectare and yielded little return, as local villagers did not support the operations.[130] Planners in Papua, New Guinea who had originally envisioned the formation of large commercial wood plantations, have recently suggested that smaller-scale ventures based on Wantok (clan) territorial boundaries and leadership may represent a wiser investment for the government.[131]

The example of Brazil tends to bear this out. The government chose to develop plantations rather than follow the path of community forestry. The price, according to Muthoo, has been extraordinarily high. The public subsidy alone has ranged from $500 to $820 per acre, and total costs give the plantation program the dubious distinction of being one of the most costly man-made forests in the world.[132]

G. Harvesting and Transport of Fuelwood

The harvesting and transport of fuelwood from community based forestry projects is done by the villagers or by the government, depending on the program. Interestingly, it seems that much of the actual harvesting is carried out by local people, but controlled and managed by one or more levels of government. In the PRIBICO

project in Colombia, for example, harvesting is carried out by community members, but the work is supervised by IDERENA (the National Institute for Natural Renewable Resources and the Environment), the agency in charge of the project.[133]

The Indian Forestry Department has devised a system of departmental exploitation of forests on a no profit, no loss basis to reduce customary pressures on forest lands and to provide a steady supply of timber and fuelwood to privilege holders in urban and semi-urban areas. In addition, selected forest areas are now worked intensively by the forestry department to provide greater quantities of fuelwood to replace stocks previously supplied by customary privilege and pilfering.[134]

The Gujarat fuelwood project in India is moving to integrate land and labor from the village and seedlings and wage employment from the Forest Department and the Panchayat. Fuelwood would be sold through government operated depots at well below market prices, to enable the poorest people to meet their energy needs.[135]

In Indonesia, the State Forest Corporation (Perum Perhutani) controls all harvesting and transport activities directly for both teak and fuelwood; local participants provide the labor.[136] The Baramati Agricultural Development Trust in Maharashtra, India will control its afforestation project until it is well established, then turn the project over to the local village government after agreement is reached about how it will be managed and who will benefit.[137]

In other cases, villagers both carry out and control the harvesting and transport activities, often through village level organizations. The VFAs of South Korea (essentially the entire village) is responsible for all aspects of the local fuelwood programs, including harvesting. In Tiro, Ethiopia the Peasant Associations are responsible for harvesting. Communities in Western Nigeria take care of harvesting without involvement by the State Forestry Service. The small holder tree program in the Philippines, although aimed previously at producing pulpwood, is one in which individual landowners harvest their own trees.[138] The same is true on the private plots individual farmers plant to trees as a part of a major integrated rural development project in Colombia.[139]

Little information is available about how harvesting and transport of fuelwood is done in community programs or about who does it. Taungya programs are described fairly completely in some cases, but fuelwood is seldom a central feature and its harvest and transport

are overlooked by analysts. In the PICOP pulpwood program in the Philippines, farm family labor supplemented by oxen and, if necessary, hired persons, does the harvesting.[140]

Some programs have introduced carts and other devices to assist human labor in the transport of harvested fuelwood. Carts have been provided to help women haul wood in regions of Upper Volta. However, Hoskins notes that where the use of these carts has not been carefully monitored, men have frequently taken them over for their own purposes.[141]

H. Distribution of Fuelwood and Other Products

Very little product has yet been realized from new community fuelwood programs, thus the distribution aspects of such programs are not very well explored. The most striking fact about community projects however, is that very little consideration is given to how it should be undertaken. Analysts clearly argue that up-front agreements, such as contracts, with villagers as to the distribution of benefits (and obligations) is one critical factor determining a project's success. Yet in reviewing existing plans for many programs, it was difficult to uncover any mention of how fuelwood from the project would be distributed and by and to whom. It is especially difficult to determine who in the community is entitled to the benefits of fuelwood production that is the result of group but not total village labor. Another program consideration is that in some cases fuelwood will have to be sold for the first time to repay program costs; the determination of prices will have to consider both local purchasing power and the socio-economic impact of the changeover of fuelwood from free good to commodity status. The distribution of the product in this case is more complicated, and may have implications for subsequent distribution patterns as a free or paid good.

Lee reports that APROFON failed because of the lack of community access to and cooperation with the program. A major problem was that APROFON managers decided unilaterally to return only part of revenues to ejidos who earned them so those ejidos without trees could use the funds to help start their own community forestry programs.[142]

In Gujarat, government firewood depots are to receive the wood from the project where it will be sold back to villagers "at prices well below those of the market place."[143] This may, at first glance, seem attractive, but unless it is sold back to villagers at prices well below their opportunity cost, it will not be effective. The VFAs in South Korea distribute wood to village households, but the

basis for the distribution is unclear.[144]

Various programs are heavily laden with "incentives" to get local people to participate, but seldom do these relate directly to the availability and distribution of fuelwood from the project once it begins to produce, or from other sources in the meantime.[145] The Forest Industries Organization in Thailand, for example, has conducted an extensive promotion campaign on behalf of its forest village program. Promises of housing, electricity, schools, and health care are used as incentives to attract laborers and families to join the forest villages.[146]

Whatever the special benefits provided to villagers as incentives to join a community fuelwood program, in many cases it is not clear that they comprise any more than one's entitlement in the first place. Education and health benefits are valued by all people to meet their basic human needs so that it may be a questionable policy to use them as a carrot to draw people into community fuelwood programs. Nao observes, "Even where there are undoubted economic improvements, these are not in themselves welcome, unless they really allow the cultivator to raise himself above the subsistence level and spare him from frustration."[147] While all community forestry programs create new wealth and, in some cases, improve the absolute well-being of the rural poor, it is not certain that they do provide any long term improvements in the standard of living or social status of these people compared to urban dwellers. Eckholm notes that even in the highly successful panchayat run Gujarat program, local elites tend to dominate its administration; he concludes the program is unlikely to effect any changes in the social stratification of classes.[148]

I. Consumption

Consumption of fuelwood is assumed to rise or fuelwood is assumed to be available with better time and place utility as a result of a successful community fuelwood program. Thus, while once facing denuded hills and a major fuelwood crisis, South Korea has now planted over 643,000 hectares of village woodlots; rural fuelwood problems are expected to be virtually solved by the early 1980s.[149] The Gujarat program, although not very old, is also providing more wood for consumption, as well as grass, fruit and other products.[150] Surely, the China program's increase of forested land by 72 million acres since 1949 has improved fuelwood availability and consumption too.

Specific village or family consumption changes as a result of community fuelwood programs are difficult to note in the literature. Likewise, whether changes occur within families or villages as to who

consumes and for what purposes or in user attitudes cannot be determined from the literature. An idea being considered in Indonesia -- that of using family garden areas for vegetables, fruit, fish and fuelwood -- would likely shift consumption patterns and attitudes about fuelwood among program participants.[151] In Tanzania, village woodlots have been used to decrease land degradation and to enable increased wood consumption. The benefits and costs of the program are unclear, however, so that many people do not choose to join the program.[152]

Another view of consumption is to look at efforts within community fuelwood programs to conserve fuelwood and to develop alternative energy sources for the community. Recent guidelines from the FAO, the World Bank, and other prominent donor organizations urge the incorporation of improvement in fuelwood consumption technology and alternative energy development into new community fuelwood programs.[153] Even so, consumption reforms are not a significant factor in most existing programs. In India, however, the government is supporting efforts to:

> conserve firewood and minimize the losses associated with the burning of dung. The Hyderabad Engineering Research Lab has designed a smokeless mud "chula" or stove that can be fabricated with earth, clay, or bricks, and saves from 20-40% on fuel. The Central Arid Zone Research Institute in Jodhpur has designed a solar cooker which can be used to cook all kinds of food. And as early as 1939 the Indian Agricultural Research Institute designed a biogas digestor or "Gobar-Gas-Plant" which produces a gas for cooking and a sludge fertilizer. By 1974, about 7,000 plants had been installed throughout India, with plans to distribute an additional 36,000 plants by the year 1979. The problem with all the above mentioned inventions is one of cost: many families cannot afford to purchase a biogas digestor or a solar cooker without some financial assistance. And in the case of the smokeless "chula", people still must be convinced that the extra effort required to build the stove will pay off.
>
> Efforts are also underway to improve the efficiency of crematoriums, reducing wood use from 400-500 kilograms to 160 kilograms. This could result in substantial savings in a country where everyone is cremated.[154]

While considerable work has been done in this area, particularly concerning stove design and kiln improvement,[155] such research takes place in a separate context from fuelwood production development. This division of effort should be ended in future programs, for consumption reform can make a valuable contribution to fuelwood production through achieving improved conservation of resources, and community fuelwood development can stabilize supplies to facilitate the introduction of new consumption technologies.

Hoskins notes that women are often given low profiles and little prominence in community fuelwood programs, without regard to their important role in the provision and consumption of household fuelwood. Women are usually least served by extension workers. They often have the least flexibility in making time for forestry work because of household obligations, the least mobility, and the least financial resources of all community members. This causes many community forest programs to overlook women's contributions to fuelwood production efforts and to ignore their particular needs in the distribution of the benefits from this work.[156]

J. Discussion

The primary reason for a community fuelwood program is to enhance firewood and charcoal availability for the members of the community. Most forestry or tree growing efforts at the community level, however, are not solely oriented toward fuelwood production. In considering a fuelwood program, then, it is essential to understand and cater to the needs of the community, which may, for example, rank fruit and forage production and erosion control higher than fuelwood production. Put another way, one is likely to find that community firewood efforts are most successful when they serve multi-purposes.

The multi-purpose nature of most community forest activities often obscures the importance of fuelwood. It is difficult, for example, to decipher the role that fuelwood will play in many planned community forestry projects. Designers often indicate that trees will be planted to control soil degradation, water run-off, etc., but never indicate whether such trees will supply fuelwood and, if so, on what basis. Likewise, if such trees are not intended to be used for firewood, there is seldom any consideration given to how such use will be curtailed. Numerous taungya projects are discussed in the literature in some detail with no reference or only passing reference to firewood.

Yet, because multi-purpose community forestry projects offer a solid base for more fuelwood production, it will usually be necessary for all participants, and especially donors, to clearly define how fuelwood will be developed within such a context. This is especially relevant in the case of integrated rural development programs. Such efforts provide resources to cope with many of the constraints affecting community fuelwood projects such as access roads, alternative sources of income while trees grow, structural shifts in land and other resource use, credit, etc. At the same time, they can diminish the attention given the community fuelwood effort, reducing it to "just another project component." Such integrated approaches can introduce other problems too. One is the common vertical organization of ministries, with little horizontal cooperation at local (district, division, county, area) levels. Another obstacle is simply poor communication, when different government departments do not know what others are doing. In some countries departments of forestry (lamentably, this is often true for all departments dealing with natural resources) have a relatively low status, lacking finance and political clout.

The aim of most community forestry or fuelwood programs is nearly completely supply oriented. Conservation of fuelwood or development of alternative energy supplies is a part of very few community fuelwood efforts. This may reflect the heavy involvement of foresters in such programs, with their emphasis on production and conservation of trees and forest land. Involvement of social scientists, energy technicians, household economists and others in fuelwood projects may add other elements to the supply focus. It also would be helpful to define community fuelwood projects in every case as those dealing with fuelwood production and conservation and the development of alternative energy supplies.

The initiators of community fuelwood programs are seldom the villagers themselves. Governments and international donors alone or acting together initiate most such programs. Many of these programs initiated from the top have been successful, especially when the communities have been effectively involved in planning and carrying them out. Other top-down programs have even been successful with relatively little involvement of the community because they so clearly met the needs of the people. Who initiates a program, then, is not necessarily a critical factor in determining its value to the people it is designed to help. Consequently there is a distinct role for government and donor assistance in identifying and responding to the fuelwood needs of rural people.

Community based fuelwood programs draw a substantial amount of support from outside the community, at least initially. The primary sources of this support are central governments and donor institutions. Their commitment to the community must be a long-term one that fills in all the gaps in support that the community cannot provide for itself. Nurseries, extension services, research and training support seem to be the most crucial, but many other support services are important as well, depending on the special needs of the community.

Management and control of community fuelwood programs is usually vested in the government as opposed to members of the community. In some cases, though, village organizations actually control and manage fuelwood projects.

Competition for land is usually a problem in areas where fuelwood programs are considered, and little interest is evoked by efforts to shift needed agricultural land to fuelwood production. As a result, marginal lands are used for most fuelwood production programs.

The tenure of land selected for community fuelwood projects varies from private to government ownership. Communal land tenure is used, but not as extensively as might be anticipated. Thus, it is important not to think of community fuelwood projects as "village woodlots." Many other forms of fuelwood production take place in community fuelwood programs.

Land allocation for community fuelwood production is largely the domain of the central government, although it is most successful when done in close conjunction with the community. In some cases, projects have failed because of this top down approach; another result of it is lack of self-sustaining community control over its own development and related decisions.

Fuelwood production is like any other agricultural or forestry production process -- the correct inputs have to be brought together at the same place over time for the desired output to be realized. Organizing the village people, various government agencies, donors, and others to enable this to happen is challenging at anytime, but especially when a "community" focus is to be achieved. The villagers must overcome competing interests and cooperate with each other, with the government, and sometimes, with donors. The best way to enhance such cooperation is to assure that the fuelwood project will meet a critical need of all villagers; a second is to seek a basis for relating various villages, government and donor activities to this need.

Contracts between the parties as to obligations and benefits is one way to help achieve this. Village or local organizations can be formulated to accomplish the fuelwood activity. These organizations bring villagers together, thereby providing a framework within which their competing interests can surface and be dealt with, and helping avoid disruption of the project.

Extension activities that deal sensitively and effectively with the issues raised in the community context are also helpful in relating community efforts with the other physical and economic inputs required. Provision of seedlings, training, research results, pesticides and other factors as needed will be easier to accomplish when the various actors involved in the fuelwood project are effectively organized and fully cooperating.

The trees planted in community fuelwood programs can be either exotic or indigenous species, depending on local circumstances. It has proven important to organize the planting of trees or to provide villagers with a clear notion of the soil, water, and light requirements of each species so that generalized planting does not result in undue seedling mortality.

Constructive support programs can be designed for community fuelwood projects that extend the impact of the project into other areas of importance to community members. Nursery activities can take root in the village as in Senegal, offering employment and income for women. Training can be given that enhances long term employment or income prospects for villagers such as enabling local people to become special forestry extension agents as in Nepal.

The straightforward economics of community fuelwood programs seem to be favorable, at least as compared to plantation costs. There have not been, however, intensive efforts to calculate the opportunity cost to villagers of being involved in fuelwood projects. Moreover, it is doubtful that the economic benefits of community fuelwood projects, as can be measured by the internal rate of return or the income statement of individuals, tell the whole story of project benefits anyway. A wide range of secondary benefits are probably just as important and infinitely harder to measure. These include aggregate consumption, redistribution of fuelwood, labor, time, land, etc., self-sufficiency, leisure, beauty and other environmental factors, and others. Serious consideration of such benefits in each community fuelwood project, together with more conventional financial ones, will provide a clearer picture of total benefits and of the "feasibility" of the project.

Harvesting fuelwood in community projects is done by villagers, but often under the control and management of one or more levels of government. Where private land or community organizations exist, harvesting is usually controlled by the landowner or the organization.

Community fuelwood projects, as planned, give little visible attention to the distribution of fuelwood. Some programs, such as South Korea's, have apparently worked out means for equitable distribution of fuelwood to households, but how the mechanism actually operates is not available in the literature. Incentives provided to encourage people to participate in fuelwood programs seldom include the additional availability of fuelwood.

Consumption of fuelwood is presumably increased, or at least maintained, by the successful implementation of a community fuelwood program. The literature, however, provides no indication of the actual consumption impact of community fuelwood efforts on a village or family level. Fuelwood conservation and alternative energy development efforts are usually not a part of community fuelwood programs so that consumption reforms that stem from such efforts are not apparent either. Both are possibilities, however, despite the lack of evidence in the literature.

Women appear to be almost entirely overlooked in developing and implementing community fuelwood projects. Their interests in such programs are central, but the literature fails in almost every case to say anything about how community fuelwood projects deal with their concerns or impact upon them.

V. CONCLUSIONS

A. Firewood

1. Source and availability

a. Source

- Almost all rural communities and a large proportion of the urban poor in the developing world heavily depend upon firewood for cooking, heating and many other domestic tasks requiring energy. Thus, trees and shrubs provide much of the fuel needs of the poor. and especially the rural poor, in most developing countries.

- Most rural people in developing countries obtain their own firewood within walking distance of their homes.

- Most firewood is taken from unmanaged lands, much of which is held communally or by a central government; some firewood, however, is taken from private land.

- Most firewood used at the community level is composed of dead trees, branches, twigs and shrubs (as opposed to the cutting of live trees), except in cases where firewood shortages are increasingly apparent or on private land.

- A very small proportion of the developing world's firewood supply is taken from managed or man-made forest areas, although such forests hold enormous potential for supplying firewood in the future.

b. Availability of firewood

- The aggregate continental forest resource supplies exceed total demand for fuelwood but they provide little relief for the scarcities found in much of South and Southeast Asia, semi-arid Africa, Central America and the Andean region of South America.

- Firewood shortages are a very serious problem in many areas of the Third World, but not in others. However, local areas of shortage exist in almost all developing nations.

- Firewood shortages are not a new problem. Deforestation (and localized firewood shortages that result) has been going on for centuries. Today's "crisis" represents an increased awareness of the current impact(s) of an on-going process initiated long ago, the dramatic escalation of that process in recent decades and of the consequences of continuing unabated in the future.

- Firewood availability is location specific throughout the developing world; within the same country, one community may have ample firewood supplies while another faces a shortage of firewood.

- The impact of firewood availability is also location specific. The combination of: 1) the resources available to the community or family to obtain firewood, 2) the community level ecological and socio-economic consequences of relative firewood scarcity, and 3) the local price and availability of alternative fuels make the impact(s) of a given decrease in firewood availability more critical in one household or community than in another.

- Availability of firewood at the village level can be increased in several ways, all of which are being attempted in various locations. Conservation of firewood as it is used to provide energy, forcing private land owners to improve and utilize their fuelwood land wisely, and establishing firewood plantations are examples.

- The availability of firewood relative to need in a community is a good indicator of its natural resource environment. The scarcer the firewood, the higher the degree of ecological imbalance and environmental degradation is likely to be.

- Most rural people still depend on indigenous unmanaged forest or savanna type land for their firewood supplies.

Fast growing species supply an insignificant amount of firewood in developing countries and do not yet meet the firewood needs of very many specific communities.

c. Availability and price of alternative fuels

- Most non-traditional fuel alternatives to firewood are not available to households in developing nations because people cannot afford to buy them and do not have the equipment to use them. Fuels like kerosene that have been within the buying power of many urban dwellers, are rapidly becoming more expensive due to petroleum price increases. What little evidence is available indicates that their usage is declining.

- The availability of firewood may be extended by integrating alternative fuels and fuel systems, especially from alternative energy sources, with firewood at the community level.

2. Access to firewood producing lands

a. Regulation of access

- National, local and private regulations and actions to restrict access to firewood producing lands exist in almost all developing countries. These include legislation, police-type patrols by forest guards, the requirement of approval by local chiefs or elders and many other forms. Nearly all of these restrictions, however, have failed to be effective. They are not enforced, too few resources are applied to make them effective, guards are bribed, etc.

- Central government regulation of access to firewood supplies exists in most developing countries, some being patterned upon regulations promulgated by former colonial governments. Government owned or controlled lands on which government regulations determine fuelwood access are a common form of central regulation.

- Traditional local access restrictions -- approval of local authorities, custom, religion, etc. -- have broken down in many rural communities because of increasing population pressures, rural industrialization, growing urban influence and the demand for fuelwood from urban communities, and the overall increases in the demand for firewood generated by these changes. The effectiveness of these local restrictions has sometimes been diminished by the overt actions of central governments -- e.g., legislation shifting adjudication of disputes from local political authority to a formal court system. In many cases, however, the central government's activities have simply gradually eroded the power of local authorities such as chiefs, village herdmen, elders, priests, etc.

- Regulation of access to firewood on privately controlled lands is usually more effective than regulation of access on government or communally owned lands. In some cases, the central government effectively controls firewood exploitation on all privately held land.

- Payment of wood collection fees to the individual, communal, or government owners of forest and other lands is an increasingly common practice, although such fees are seldom enough to pay for the management and ownership costs of the woodland.

- Regulation of access to firewood, can and often does create conflicts between those who use or need the wood and those who regulate access to it; this is especially true of when the regulation is by persons or government agencies that are not close to the common life and needs of the people in the rural area.

- Informal or indirect means of regulating access to firewood sources exist in many rural communities; e.g., religious groves, "reviled forests," ghost trees, etc.

- Ritual attitudes towards animals, such as prohibitions on eating or slaughter, can limit access to fuelwood by contributing to its destruction through uncontrolled grazing. Hostility from neighboring groups, or civil disturbances may also restrict access to firewood resources.

b. Land tenure

- Central governments own only a small percentage of the firewood producing lands in most developing nations, but deforestation and fuelwood shortages have led some nations to increase government holdings. Conservation and industrial timber production is often emphasized on such holdings, sometimes to the exclusion of firewood needs.

- Rural communities in almost all developing nations have enjoyed certain customary privileges on nearby forest lands from ancient times, but legislative reform has reduced the domain in communal tenure in many areas, leading to a decrease in access to firewood at the local level.

- Rights over land and the fuelwood on the land are not exclusively determined in rural communities by land control or ownership. In some cases, the rights to trees on privately controlled "communal" land belong to the first settlers of the land. On the other hand, sometimes private tenure co-exists with common lands so that members of the community all possess rights for gathering wood on the latter.

- Where private tenure exists, adjacent forest land use is frequently given to the family that retains agricultural use rights to the area.

- Some tenure systems detrimentally affect the share of firewood resources gained from tree-planting and forest land management that flow to women.

3. Harvest/collection and transport

a. Labor

- Women play a significant role in the procurement of firewood for domestic use in most parts of the developing world. They are responsible for the bulk of wood collection in Africa while men handle much of the collection in Central America. It is increasingly commonplace, however, to observe both men

and women sharing this responsibility and to find continual modifications occurring in traditional patterns. For example, more of the responsibility for obtaining firewood often shifts from women to men as the locus of firewood harvesting, collection and transport moves farther from a village.

- Each household is responsible for collecting its own firewood supplies in most areas of the developing world. Sometimes, however, members of one nuclear household collect firewood for members of another, especially if the members of both households are part of the same extended family.

- Paid collectors, although they only provide a very small part of the total labor for fuelwood harvest and transport, are increasing in number due to the increasing monetarization of economies and the growing tendencies towards division of labor. In fact, there is a clear trend toward commercialization of the fuelwood collection process at all levels in many areas.

- Firewood collection is usually a social function; few collectors (particularly women) go alone.

- Firewood collection is and was a source of limited enjoyment in many rural areas; increasing shortages make it less and less likely that this is the case in many communities today. Firewood collection is hard work, and growing shortages make it one of life's major sources of anxiety for collectors.

- There is a substantial body of technical knowledge among local collectors concerning the cooking, heating, medicinal and other properties of local species. In different areas different species and different parts of trees are preferred for firewood use, although firewood shortages have forced the substitution of less favored species and tree parts -- tree stumps, roots, etc. -- in many cases. Attitudes and values affect the use of certain species as well -- e.g., cashew trees are believed to be the homes of ghosts in an area of Senegal so they are not used or protected.

- Wood is usually left out to dry, which increases its energy content. Shortages make it increasingly difficult, however, to set aside any wood to dry.

b. Distance and frequency of trips

- Wood collection begins near the home and gradually increases in distance as sources are exhausted. Shortages also necessitate more frequent gathering to secure sufficient supplies.

c. Weight and volume of loads

- Existing data on the weights and loads of firewood carried in collection is minimal and usually of limited reliability due to the absence of survey data and the physical difficulties of such measurement. However, human loads appear to be almost the maximum that either men or women can comfortably carry, about 50 to 100 pounds.

d. Means and cost of transport

- Human backs and heads carry most of the developing world's firewood on its initial journey toward the consumer. Animal labor, carts, and motor vehicles are also sometimes used. As firewood supplies recede farther and farther from population centers, transport is gradually changed from human to vehicular forms.

e. Technology used

- Some combination of machetes, long knives, axes and hooks on the ends of poles are used to reach and cut firewood. Chain saws are used in some areas.

- Firewood collection is concentrated in the dry season, when any firewood is available and there is usually more labor available.

f. Seasonality

- Firewood harvested in the dry season is stored in some areas for the wet season. Firewood for several days is also gathered at one time in some rural communities, the surplus being stored until it is used.

- Some communities switch to gathering dung or crop residues when they are available or when firewood is less available as in the wet season. This substitution and dung burning can have long-term destructive effects on soil fertility and agricultural productivity.

4. Distribution

a. Means of allocation

- Several means are used to determine who gets firewood once it is collected. They include allocation by household, by demand and price where firewood is sold and by barter where it is traded. A recent phenomenon that increasingly "reallocates" fuelwood is theft, resulting from increasing scarcity of firewood in some areas.

b. Households

- Firewood is usually distributed among household members, although some extended family relationships result in wood being distributed among several nuclear "households."

c. Sales

- Sales of firewood are increasing, but still account for only a small part of all firewood used. Firewood availability and the price and availability of alternative fuels are important factors in determining whether this commodity is free or sold, and where and how its price is set. While most firewood is still collected rather than purchased by the end user, both self-collection and sales co-exist in many rural communities.

- Firewood sellers at the village are often poor, as firewood selling is seldom a high status occupation. However, those who sell firewood in urban areas are sometimes substantial businessmen with employees, trucks, etc.

- Seller income varies from village to village, and between those who sell in rural and urban areas. Selling firewood is often the sole source of support for those engaged in it. It also provides an important source of employment for others in the agricultural off-season. Sometimes the seller is the firewood cutter; in other cases dealers or their agents buy firewood from cutters and sell it in towns, or hire their own cutters. Firewood sales are providing windfall profits to local merchants in some areas as a result of firewood shortages.

- Fuelwood prices have increased dramatically in the last decade, and scarcity is a central factor behind the increase. People who depend on firewood and buy it are spending an increasing proportion of their household budget on this item.

d. Barter

- Barter is used as a means to distribute firewood in some areas. Most firewood is traded for food products.

e. Theft

- A growing means of allocation is the theft of firewood, especially in areas of acute shortage.

f. Shortage

- A substantial amount of casual storage of firewood goes on at the household level in many areas. Firewood sellers, foreseeing a boom in their market, are beginning to invest in commercial storage systems, which will increase their power to regulate supplies and to set prices.

g. Regional competition

- Rural and urban communities are often in competition for firewood resources. Such competition often results in one or the other facing a shortage; which interest wins out depends on location-specific socio-economic

factors, but urban areas tend to have more of the resources (with political and economic power being the usual means for allocating scarce supplies between these areas) necessary to prevail. The poorest groups in both areas invariably end up bearing the burden of any shortage.

5. Consumption

a. Consumers

- Rural households in developing countries consume the most firewood; they are almost completely dependent upon it and other phytomass sources for the energy they used for several major purposes. In several countries nearly 100 percent of all households use firewood (and charcoal).

- High income families and urban dwellers tend to be less dependent on firewood than lower income or rural families. Where possible, they often shift from firewood to charcoal, kerosene, bottled gas and other fuels. The relationship between income levels and fuelwood consumption, however, is complex. Increases in rural household incomes often lead to increased fuelwood consumption. Increases in urban household income usually result in a switch to using charcoal or other alternative fuels -- but exceptions to the generalizations are seen in many nations.

- Many rural and some urban industries depend entirely on firewood (and charcoal). These include bakeries, tailors, brewers and other local businesses which sometimes represent a major source of employment and income in rural and urban areas.

- Rural and urban families and industries closer to firewood supplies usually consume more firewood than those further from available supplies. Firewood consumption declines sharply in rural communities when supply sources become more than a day's walk (10-15 kilometers) away. However, firewood is transported over significantly longer distances in areas where deforestation is severe and demand is high, for the simple reason that no alternative fuel sources are available.

- Within families and households, women "consume" the bulk of the firewood. They play the dominant role in the organization and utilization of firewood for cooking, heating and other household purposes.

- Men "consume" most of the firewood used by local industry in that they, not women, are usually responsible for organizing and using firewood for industrial processes.

b. Uses of firewood

- Firewood is consumed for numerous purposes in rural and urban areas: cooking, heating, manufacturing, ceremonial occasions, as torches, insect repellant, to power railroad locomotives and as a part of a girl's dowry.

- Cooking uses the most firewood in both rural and urban areas; general estimates indicate that cooking accounts for 80 percent of the firewood and charcoal used in developing countries. Most cooking is done over an open fire, but various stoves are also used in many areas.

- Space and water heating is the second most major use of firewood in both rural and urban areas. Space heating with firewood occurs in many areas of the developing world, usually on a seasonal basis. Fires are sometimes kept burning all day and well into the night to ward off the cold. Heating of bathing water or washing water is also extensively practiced in some areas.

- Industrial or cottage-type manufacturing also uses substantial quantities of firewood. Although they sometimes use it in conjunction with other fuels, most of these industries are heavily dependent on firewood and charcoal to make such things as baked goods, manufacture metal products, brew beer, dry fish, tobacco, bricks, and pottery, cure leather, etc. Local food products industries are the largest consumers of firewood.

- Firewood is used for many ceremonial purposes; cremation is perhaps the most vivid example.

c. Effects of firewood shortages

- Shortages of firewood relative to need reduces firewood consumption and alters traditional firewood use and consumption patterns in significant ways. As soon as supplies are available again, consumption and traditional uses of firewood usually return to normal.

- Firewood shortages often reduce the number of hot meals cooked per day, and alter diets to favor foods requiring less cooking time. These changes can have adverse consequences for nutrition and can influence the crops produced or the course that agricultural development takes in the area. In some cases, more and more food is consumed uncooked.

- Shortages result in smaller fires and fewer fires for cooking, heating and other uses.

- Shortages sometimes motivate additional firewood conservation measures. Attempts to improve the efficiency of traditional stoves or open fires, for example, are one such measure. While many improved stove designs have emerged, however, few have been successfully adopted by rural communities, for a variety of social and economic reasons.

- Firewood shortages could lead to higher prices, business failures, and unemployment in many of the industrial activity areas in rural and urban communities. Such businesses, although small, are a major source of employment and income and are less able to convert to alternative fuels than larger industries.

- Escalating consumption of firewood in urban and industrial markets due to higher petroleum prices is

likely to drain wood resources from many rural areas faster than can be counteracted by tree planting and conservation measures.

- Firewood shortages result in increasing demand for and use of alternative fuels. In rural areas, crop residues and animal dung are used more extensively as a result of shortages, as is charcoal. Relatively few non-traditional fuels are available or affordable in most rural communities. In urban areas, more charcoal and other alternative fuels are used when firewood shortages occur, but the availability of these fuels is often undependable and they are expensive.

6. Women

a. Access

- Some land and tree tenure systems adversely affect the share of firewood resources gained from tree planting and forest land management that flow to women, directing them instead toward the men of the society who then will apportion it to the women.

- Other tree tenure systems, although unique, produce the opposite result; private land owners cannot refuse women access to trees on their land for use as firewood.

b. Harvest/collection and transport

- Although firewood collection is becoming a less sexually stratified task, women still bear the primary burden for securing sufficient fuel supplies for domestic cooking and heating in most parts of the world; this is especially true in Africa which has been slower to relax this sex role.

- A woman is generally responsible for collecting her household's (extended or nuclear) fuel supply until she becomes physically incapable of doing so, with no regard for age. The task may be lightened by a helpful daughter or daughter-in-law.

- Women transport the collected firewood back to the village almost exclusively on foot, often carrying headloads of up to 75 pounds or dragging a bundle of sticks behind them.

- Firewood collection has a social function for women who go out in groups to search for fuel. Each women does her own collecting, however, and there is very little cooperation among them besides assisting to lift the loads to their head for the walk home.

- Although women from a few cultures have purported to enjoy wood collecting, for the vast majority it is considered the most tiring and demanding household task, with the least to show for itself, particularly in light of the growing scarcity of supplies.

- Land tenure patterns regulate access as well; government land means government regulations, communal land (where it still exists) requires traditional guidelines and forms of approval for access; private lands usually require permission to cut wood or the purchase of wood from the owner.

- Natural factors play at least as important a role as regulations in controlling access to wood raw material for charcoal production or severe working conditions where the wood is available determine access to it.

- The scarcity of fuelwood sends women out farther in search of sufficient firewood supplies, thus increasing the time demands made by household activities, to the exclusion of other activities.

- As fuelwood supplies recede farther from the community, women tend to gather that which is more easily available (5-10 km radius of home) and additional supplies are collected by the men who go farther away, and bought from firewood sellers.

c. Distribution

- The household, with women at its core, is the basic unit for fuelwood distribution. Even in cases where men collect firewood, women receive it for cooking, heating and other domestic tasks.

- There are many women who are sellers of firewood (and charcoal), particularly in the rural areas. Generally, it is the older women who undertake this rather low status job as a source of income -- younger women find it degrading.

d. Consumption

- Women are the major consumers of firewood; they are responsible for the organization and utilization of firewood supplies for household cooking, heating and other related (heating, bathing and washing water) activities in most areas of the world; rural women consume more firewood whereas urban women consume more charcoal.

- Women's entire pattern of nutrition, cooking, heating, etc. is sometimes altered as a result of fuelwood shortages that reduce the kinds of food they cook, the time spent cooking and heating, etc.

- Older women are often dependent on firewood for small cottage industries, such as the production of beer from millet to provide their meagre livelihood. The increasing fuelwood supply scarcity can be devastating.

B. Charcoal

1. Source and availability

a. Source

- o Charcoal is mostly produced from hardwoods (although it can be made from a variety of materials such as coconut shells, etc.) gathered from land that is usually unmanaged.

- o Like firewood, very little charcoal is produced from intensively managed forest resources. Some efforts, however, have been made to develop charcoal production in cooperation with managed afforestation efforts.

b. Availability

- o Charcoal supplies are progressively falling below effective demand in most areas where charcoal is a traditional fuel.

- o Urban charcoal needs often compete with rural firewood needs for the same limited wood resources. Regardless of which regional interest gains the greater share, firewood supplies are decreased in rural areas and shortages are often created.

c. Price and availability of alternate fuels

- o Charcoal has become an increasingly important fuel in urban areas. It is used for cooking even in some instances where income levels allow for the purchase of kerosene, bottle gas, or electricity.

2. Access

a. Unregulated access

- o Most nations have regulations restricting access to the wood material needed to make charcoal. However, the relatively uncontrolled exploitation of these resources is, in practice, the norm.

b. Means of regulation

- o Regulation of access to wood for charcoal production takes several forms: government controls, land tenure patterns, natural barriers and informal and economic means.

- o Government control of access includes outright prohibitions on cutting wood for charcoal production in certain areas and prior approval in the form of a permit.

c. Impact of wood shortages on access

- o Raw material shortages pit charcoal makers against rural dwellers in competition for wood, competition that often leads to hostility and social divisiveness.

- o Shortages of wood for charcoal leads to its production progressively further from the locations where it is consumed. In some cases, charcoal producers leave home for weeks at a time. In others, they have migrated so as to live near their work, becoming social isolates in the process.

- o Shortages of wood for charcoal leads to the use of non-preferred species that make poor quality charcoal. Thus, access to softwood forest plantations or other sources of non-preferred wood begin to be important when hardwood shortages occur.

3. Production and transport

a. Degree of commercialization

- o A much higher degree of commercialization exists in charcoal production and marketing than in firewood marketing, most charcoal being produced by specialized private individuals, organized teams, and small "associations." Cooperative and governmental production exists in some countries, but it is not a significant source of supply.

- o Quite complex and specialized charcoal marketing systems exist in many nations. Marketing is carried out on a door to door basis in many urban areas.

b. Technology and costs and efficiency of production

- Most charcoal at the community level is produced in earth stacks or pit kilns that cost virtually nothing to build but that yield a product of only 8 to 12 percent of the weight of the dry wood used. More efficient charcoal production technologies exist, but they are not a significant source of product because their high cost has prevented their acceptance by traditional manufacturers.

c. Labor

- Traditional methods of charcoal production are labor intensive and are an important source of employment and income in many communities.

- Charcoal production is hard, often dirty, work. It is usually the responsibility of men, but women and children often assist in its production.

d. Species and part of tree used

- Hardwood species are preferred for charcoal. The part of the tree used in charcoal production depends on the technology employed. Traditional stacks and kilns use large limbs and trunks almost exclusively; with smaller branches used only for firing material because they tend to burn completely or to make small, crumbly charcoal. Newer kiln designs can use light shrubs and twigs for producing charcoal.

e. Distance and frequency of trips

- The distance traveled to gather raw material for charcoal production depends on the locations of the species used in relation to market sites, and upon the degree and consistency of local charcoal demand. Distances are usually substantially longer than for firewood and exceed 300 kilometers in some areas, such as Khartoum. Charcoal is economically more advantageous than firewood only when wood is a substantial distance -- up to 50 miles or more in East Africa -- from the market place.

- o Daily trips are usually made for charcoal production and transport whenever possible, but in some areas burners reside at charcoal production sites for weeks at a time. The amount of time spent traveling on daily trips is often equal to the amount of time spent working at the charcoal production site.

f. Weight and volume of loads

- o Charcoal is usually sold in large burlap sacks weighing about 60 pounds each; the volume of charcoal transported depends on the mode of transport used.

g. Means and cost of transport

- o Charcoal is transported by human portage, animal carriage, bicycle, and motor vehicle, including water and rail transport. A great deal of charcoal is carried by motor vehicle, but even then some form of human transport is involved at many points in the transport system (e.g., head loads from the bush to the truck pick-up point, hand movement at the urban market level, etc.)

- o Transport costs are variable, ranging from zero cash costs in the case where a charcoal producer carries his own product to market, to ton-mile charges for large long distance trucks.

h. Seasonality

- o There is often distinct seasonality to charcoal production which depends both upon the availability of alternative uses of labor and the wetness or dryness of the season of the year. In the agricultural off-season many farmers make charcoal; more charcoal is produced and transported in the dry season than in the wet season.

i. Ecological impacts

- o Strong demand for charcoal has resulted in the denudation not only of forest lands but also of shrub and savanna zones in many countries. The consequent shortages of

wood usually lead to the use of smaller trees and less desirable species as well as to an increased disregard for official cutting regulations. Land degradation, lowered pasture, livestock and crop output and related environmental problems are the results of such intensive charcoal production pressures.

j. Changes in production and transport as a result of shortages

- Charcoal production is attempted with smaller or less desirable trees, in smaller amounts, at greater distance from market centers and in sometimes flagrant disregard for access restrictions when wood for charcoal production is scarce.

- Transport of charcoal shifts from human forms to the use of motor vehicles as charcoal production takes place at greater and greater distances from market centers due to the scarcity of wood for charcoal.

4. Distribution

a. Means of allocation

- Charcoal is produced mainly for cash sale and is usually purchased by urban dwellers and industries with enough capital to buy it, in contrast to the firewood market situation which, for the most part, exists in rural areas outside of the monetary economy. Thus, price is the primary means for allocating charcoal.

- The price of charcoal varies substantially between countries and regions. Charcoal prices are rising rapidly unless regulated by the government (which occurs in a few nations but is seldom effective). The rising cost of transportation and the increasing distances involved are important factors behind this increase.

- The price of charcoal relative to the price of alternative fuels varies in different countries and areas. Its price is sometimes higher than all other fuels, but is it lower than most other fuels in other cases.

- o Charcoal is sometimes allocated between the owner of the tree and the charcoal burner on a "share" basis.

- o Much charcoal is allocated according to long standing supplier-customer relationships. Regular customers usually pay the full market price, but they obtain preferential treatment as to the quantity and quality of the charcoal they buy.

b. Distributors

- o Charcoal is sold in central market places and door to door in developing nations, with men and women serving as sellers in both cases. The roles of each vary according to the country and culture involved, but relatively fewer women are involved in charcoal distribution than in firewood distribution.

c. Storage

- o Charcoal is stored by producers, wholesalers, retail merchants and consumers. Such storage results for several reasons: because there is no way to transport charcoal until a trader appears; to wait for a higher price; to provide inventories; to meet day to day or wet season requirements.

d. Regional distribution

- o Most charcoal is produced from wood gathered in rural areas and sold in urban markets. This tends to drain firewood resources from rural communities which have little or no alternative energy sources.

5. Consumption

a. Consumers

- o Charcoal consumers include homemakers, businessmen and government officials, with households being the most important consumer category in terms of volume.

- o Most charcoal is consumed by urban dwellers who find it to be an effective and dependable source of energy.

Rural people find charcoal expensive relative to inexpensive or free wood supplies.

b. Uses of charcoal

- Charcoal draws a higher price and is a more desired energy commodity than firewood in urban and industrial environments because of convenience factors: it is almost smokeless, is quick starting, has a highly concentrated heat, and has a low bulk that allows it to be used more easily than firewood in indoor stoves and industrial furnaces.

- Household charcoal is used primarily for cooking and heating; businesses use charcoal for cooking and heating, canning, ironing, blacksmithing, brickmaking, tile burning, and other purposes; and farmers use it for crop drying and curing, especially in the case of tobacco.

c. User attitudes

- Many urban dwellers have used charcoal instead of other commercial fuels because its supply is more dependable; but this dependability breaks down when fuelwood becomes scarce.

- Wealthier urban families often shift from charcoal to other fuels for reasons of convenience and status; they sometimes shift back to charcoal when kerosene or gas is in short supply.

- Many rural and urban families do not use charcoal, not only because of its high price, but because the charcoal burner needed to use it effectively costs money as well.

- Charcoal is a higher status fuel than firewood in most rural areas, primarily because its use shows a family can afford to pay for it; its use also eliminates the need to gather as much or any firewood which is important to some where the task is especially onerous.

- Convenience is another aspect of charcoal that helps determine its consumption. It heats much faster than

firewood, does not flavor food, and is easier to use.

- Charcoal users react to the impacts of its production on their natural environment according to their needs for charcoal and their interests in the natural environment.

6. Women

a. Production

- Although considered men's work, women and children frequently assist with charcoal production. In some areas women do produce charcoal, although they are progressively being replaced by men as the raw materials for charcoal become more distant from the villages where women live.

- Women and children are being left in the rural villages as men pursue activities brought about by the commercialization of firewood and charcoal. While the men work in charcoal production and selling, the women and children are left to contend with added household tasks and agricultural activities in their absence.

- The entire family of a charcoal burner is sometimes forced to move into the isolated areas where wood for charcoal production is available. This has countless costs for the women involved who must provide family amenities under harsh and isolated conditions.

b. Distribution

- Women market charcoal in many developing countries both in urban and rural areas; they sell charcoal door to door and in central market places.

c. Consumption

- Most charcoal is consumed by urban women who use it for family cooking and heating. They also use it for ironing, to dry foods and to cook foods and baked goods on a small scale for commercial sale.

- Many women operate businesses such as beer making, restaurants, and clothes washing and ironing that use charcoal.

- Women prefer charcoal for many uses for several reasons; they have a good sense of what type of charcoal is best for each use. Some prefer to use charcoal because it implies a higher status than the use of fuelwood.

C. Community Fuelwood Programs

1. Reasons for programs

- Community fuelwood programs are designed primarily to alleviate shortages of fuelwood experienced by people in rural and urban areas.

- Nearly all community fuelwood programs are supply oriented; few emphasize conservation of fuelwood as it is used or the development of alternative energy sources or include them as integral project components.

- Numerous community fuelwood projects or programs are a component part of other programs such as reforestation, environmental improvements, industrial timber production, etc. In most cases, these other programs take priority over fuelwood production or are at least of co-equal importance with it. They often provide fuelwood as a part of their output, however, so that their goals are usually compatible with the objectives of community fuelwood programs.

- National politics play an important role in shaping community fuelwood programs. The organization of rural communities for forestry labor sometimes serves to establish or augment political control over rural areas through the stabilization of populations in some nations and to implement broader political strategies to achieve mass participation in others.

2. Types of programs

- Numerous production and management systems have been devised to achieve various multiple purpose community forestry programs, including fuelwood production.

3. Initiators, supporters and managers of programs

- Central and regional governments and international assistance organizations have been responsible for the initiation and support of most community fuelwood programs. Only a few cases can be cited in which a community or village initiated its own fuelwood program (e.g., some Korean villages) or in which a community had a significant input into the design and implementation of programs authorized by the government.

- The involvement of international donor agencies in these programs is significant and involves both initiation and support. Support ranges from the provision of substantial expatriate technical assistance, hardware, and other inputs and foreign exchange to only the provision of specific technical information subsequent to requests by program participants.

- National governments play a surprisingly central role in managing and controlling community fuelwood programs; regional governments are also involved in management of these programs.

- In some, but not many, community fuelwood programs, the community manages and controls the effort. When this is the case, its management is carried out through local associations or village councils. Only in the former are individual community members directly involved in program management.

4. Land use

- Land used for community fuelwood projects tends to be marginal land in the community that is not well suited for other more productive uses.

- Most land now used for community fuelwood programs was previously used for fuelwood production as well. Exceptions include areas formerly under shifting cultivation, roadsides, and canal and river banks.

- The land area involved in community fuelwood programs tends to be small, both in an absolute sense and relative to the total fuelwood requirements of the community benefitting from the program (with the notable exceptions of the China and Korea programs).

- Private, public, and government lands are used for these programs in different nations. Only in a few cases are local bodies consulted about land allocation for these programs, although such consultation does occur in some of the newer and proposed programs, as well as in the saemaul movement in Korea.

- Land reallocation for community forestry development is usually carried out by the central government, often with little consultation with local people. Land reallocation can result (as in East Kalimantan) in an inequitable distribution of land favoring wealthier individuals and groups.

5. Production of fuelwood

a. Organization of major actors

- Numerous cases exist in which the failure of community forestry efforts are attributed, at least in part, to the lack of community involvement in the planning of the project. Many of the more recently initiated programs that do include community involvement in planning and administration show more promising results.

- The extension service has proven to be a major influence in helping communities develop community fuelwood programs. Unfortunately, most national forestry departments are incapable of attracting and coordinating local community participation in fuelwood programs on an extensive scale. Shortages of qualified personnel and an absence of forester training in community-level extension work make it difficult for these departments to identify and address the socio-economic priorities of rural villages.

- Village panchayats, peasant associations, cooperatives, and other village organizations are helpful in successfully designing and implementing a project, if introduced at the early project planning stage.

b. Species

- Exotic species have been tried in many community fuelwood and related programs and are still recommended highly, especially relatively new exotics such as leucaena. Indigenous species are now being seen as relevant, however, and in some cases they are popular. Villagers are sometimes allowed to participate in species selection, but not always.

- Fuelwood shortages in some areas have resulted in species such as teak being used for fuelwood; thus, valuable species for timber or other uses have been diverted to firewood.

c. Methods of production and management

- Participation by local community members in the implementation and management of fuelwood programs is a significant factor in the success of the program. This participation includes planning, land clearing, tree planting, protection from animals, etc.

- The introduction of short-term income producing crops and trees into the longer term woodlots has helped create successful community fuelwood programs.

- Local government participation and authority in defining objectives, carrying out and managing a community fuelwood project is also an important factor in assuring its success.

d. Backup support systems

- Effective nursery, training and extension services are integral components of a successful community fuelwood program. Unfortunately, quality services in these and related areas are not available in many developing countries as backup support systems for community fuelwood programs.

- Many forestry departments lack the authority to legislate and enforce land-use regulations and other measures necessary for the development of community woodlots and other sources of fuelwood production for community use. (The Korean VFA program, on the other hand, owes much of its success to institutional reforms augmenting the staffs and strengthening the authority of the Office of Forestry and to the support of local Village Forestry Associations).

- Small-scale village woodlots have proven to be a cheap and effective means of producing fuelwood in many cases; significant savings have been achieved in Ethiopia, for example, compared to previous large-scale commercial fuelwood plantation efforts.

6. Harvesting and transport of fuelwood and other products

- Harvesting of fuelwood in community projects is carried out by villagers, as is much of the transport. In many programs, however, both activities are controlled and managed by government, often from the central level.

- Little information is available regarding how harvesting and transport are done in community programs and who does it. Community labor is obviously involved, however, and entire families sometimes participate.

- Some programs have introduced carts and other devices to assist in the transport of fuelwood.

7. Distribution of fuelwood and other products

- Little consideration appears to have been given to how distribution of fuelwood will be accomplished by community fuelwood projects. Some allocate it to each household although the basis for the allocation is unclear.

- As market prices for fuelwood have outpaced the purchasing power of rural people, many governments have had to establish firewood depots that sell low-priced fuel to help discourage theft and pilfering of forest reserves. The output of some community fuelwood projects is intended to flow through such depots.

- Many incentives are used by governments to make participation in community fuelwood projects attractive to individual people, but increased availability of fuelwood is seldom mentioned as one of them.

- Several nations have invested considerable amounts of time and effort in publicizing community forestry efforts and encouraging local participation. Often these campaigns use the promise of economic and social benefits as an incentive to join the programs, but it is not clear that these benefits represent anything above those basic human needs that should be provided all citizens. While these programs do create new wealth, and in many cases, provide new lands for villagers, it is not certain that they provide for any long-term improvements in the relative standard of living or social status of these people compared with urban dwellers.

- In many community forestry programs in which fuelwood production is not the primary focus, the forest worker receives no direct benefit from the trees he cultivates (his benefits stem from growing crops around young trees and from salaries paid him by the program). This situation gives rise to the worry that, as trees mature and available land for food crops diminishes, the workers will lose interest in the project.

8. Consumption

- o A few community fuelwood projects have increased fuelwood availability to the point where consumption levels for those involved have surely been increased or at least maintained, but little evidence is in hand to verify this for certain.

- o While guidelines issued by the FAO, World Bank and other prominent donor agencies urge the integration of improvements in fuelwood consumption technology and alternative energy development into new community fuelwood programs, there is little evidence that consumption reforms have been included in existing programs. What efforts exist in this domain operate autonomously from fuelwood production and community fuelwood programs.

9. Women

a. Reasons for programs

- o Women are rarely given adequate consideration in all aspects of fuelwood projects, despite the fact that they are primarily responsible for wood collection and utilization, and often the initial establishment and tending of the wood stock around the village.

- o In that women carry so much of the burden of collecting fuelwood, one of the important reasons for developing a community fuelwood program is to lighten the increasing burden imposed on women by fuelwood scarcity. While this is usually not a predominant factor in developing such an effort, it can be a welcome by-product.

b. Initiators, supporters and managers of programs

- o In that most community people have little input into the design and implementation of community fuelwood programs, it is doubtful that women play a significant role in initiating such efforts, even when their need for them is very great.

- Women can play a support role for community fuelwood programs as in the case of Senegal where they grow seedlings for use in the local community.

- Some professional women are involved with the guidance and management of community fuelwood programs in their role for forestry extension workers.

c. Production of fuelwood

- Women play mostly a supportive role in the production of fuelwood in community fuelwood programs. A few raise seedling; most provide food, carry water for the seedlings and otherwise support men in planting and caring for woodlots.

d. Harvesting/collection and transport

- Women are involved in harvesting and transporting wood from community fuelwood projects, but the relative degree of their involvement as compared to men or to their role before the project was undertaken is not clear.

e. Distribution

- Women are often given low profiles and prominence in community fuelwood programs without regard to their traditional responsibility for providing fuelwood for domestic needs in many areas. As a result, their particular needs in the distribution of benefits from such programs are often overlooked.

- Women appear to play a less significant role in distributing fuelwood in community fuelwood projects than when customary practices are followed. Distribution is less linked to harvesting in the new oommunity fuelwood programs and more linked to allocations per household, sales from special government fuelwood depots, etc.

f. Consumption

- Women have a wealth of knowledge regarding the consumption aspects of fuelwood, including cooking,

heating and the medicinal properties of indigenous plant species. This information, which is usually passed down through the generations, has been little recognized by foresters, outside advisors and others involved in developing and implementing community fuelwood programs.

VI. ISSUES AND RECOMMENDED GUIDELINES

This chapter considers issues raised in the above analysis of the socio-economic context of fuelwood use in small rural communities. The six overall issues raised by the analysis (Table 15), are framed as key questions concerning community fuelwood programs. As such, they should be of interest to communities, host country governments, donors and others involved in meeting the energy and related needs of rural communities in developing countries. Although treated separately for analytical purposes, these issues overlap and all six should be considered for each location specific community fuelwood program.

Each of the six major issues is broken down into numerous subsidiary issues for purposes of the analysis and discussion below. These lesser issues deal with narrower aspects or component parts of the major issues.* Both the major and subsidiary issues are presented in this chapter as underlined questions. Guidelines to be followed by AID and others in resolving subsidiary issues are presented following each question. It is important to understand that the guidelines presented following each underlined question <u>are not answers</u> to the question. Rather, they point out the information and analysis required to answer each question in the context of a particular community.

The guidelines are specifically formulated to account for the fact that socio-economic aspects of fuelwood use in rural communities are highly location specific. Each community fuelwood project, in attempting to account for the uniqueness of a community's circumstances, will be different. The issues and guidelines below are intended to help in approaching and understanding the unique circumstances affecting each existing or potential community fuelwood program. Thus, neither the issues or the guidelines are universally applicable. The guidelines do not and cannot provide answers out of context; nor do they compose a handbook on how to obtain "right" answers in a given context. The best methodology to use in obtaining such answers should be decided on the basis of the circumstances that pertain in the village or community. Both the issues and the guidelines do,

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* In the case of charcoal, relatively few issues are identified regarding community fuelwood programs <u>per se</u>. Such programs are unlikely to involve charcoal production to meet community fuelwood needs (even as a component of a larger program) except in the rare instance where firewood can be produced only at a large distance from the community. However, charcoal related issues affecting rural communities are considered.

Table 15: Major issues regarding community fuelwood programs in developing countries

A. What aims can be achieved by a community fuelwood program?

B. What type fuelwood program best meets a community's needs?

C. How can community fuelwood programs encourage broad scale local participation?

D. What resources do community fuelwood programs require?

E. What are the management requirements of community fuelwood programs?

F. What are the costs and benefits of community fuelwood programs?

however, point out the kinds of information and analysis needed to appropriately identify, design, implement and evaluate specific community level firewood and charcoal projects.

Ideally, the issues and guidelines below should be applied where the potential for a community fuelwood program truly exists. Such programs are not for all times and places, nor will they solve every problem where they can be initiated. In fact, successfully initiating and implementing them is usually very difficult and will, in the first instance, depend upon whether certain conditions are present in the area where the program or project will be undertaken. For example, a community must exist if there is to be a true community fuelwood program. In many locales throughout the developing world, however, there is no "community" in the sense of a group with sufficient cohesion and isolation to undertake a common effort toward a mutually beneficial goal, especially over the very long term as is required by a fuelwood production effort.

Given a community, most or all of the persons within it must share common interests, needs, aspirations and problems, especially as regards to fuelwood. They must also share mutual, well understood goals and attribute the same priority to the goal or goals of a fuelwood program. All the people in the community, or at least most of them, must participate in the fuelwood program.

Adequate support of the program by the relevant levels of government is also necessary at the local level. It should include detailed technical (trees, pesticides, water, etc.), financial, institutional (research results, extension assistance, etc.), and policy support (price policy, tenure laws, etc.). This support must also include a strong and effective commitment by the government to much the same goals for the fuelwood program as those held by the community.

The availability of adequate resources for the program -- labor, land, capital and management -- at the community level is also necessary. When resources are scarce, even a very strong need to assure fuelwood supplies in the long-run will not override short-run demands for them.

A detailed plan for the allocation of costs and benefits and a clear understanding of the plan and its goals with the community is also required if a community fuelwood program is to be successful.

It is especially important to precisely define how labor and other community resources will be compensated, how and to whom wood will be distributed and who -- individuals, community, other government agencies -- will do what in implementing and managing the project.

A. ISSUE: What Aims Can be Achieved by a Community Fuelwood Program?

Community fuelwood programs, if correctly conceived and implemented, flow from the needs and goals of the communities they serve. Thus, several aims can be accomplished by such programs, sometimes at the same time. Among these aims are increased fuelwood production, conservation of fuelwood, improvement in the ecological balance of the community, provision of tree by-products (spices, fruit, bark, gums, forage, etc.), enhanced rural industrial growth, and local control of energy resources. Sometimes there are significant conflicts between these aims. Also, a community fuelwood program may face serious constraints in achieving even one of them. For example, just producing enough fuelwood for the community may require such a large effort that it cannot be achieved by the smaller, more intimate "community fuelwood program." Subsidiary issues involved with using community fuelwood projects to achieve various aims are presented below. Guidelines are suggested for resolving each subsidiary issue in a location-specific context.

1. To what extent can a community fuelwood project produce enough fuelwood to meet the community's needs?

Guidelines

- Listen to the needs expressed by villagers and village authorities in describing their critical fuelwood requirements and problems. Consider cooking, heating, manufacturing, time available, children, women, costs of collection, status, technology of harvesting, etc.

- Specify community demand for firewood by type and season over time in conjunction with the sustainable yield of community fuelwood program resources; consider the price and availability of alternative energy sources and villager's willingness to use them.

- o Explore with villagers which trees are most appropriate for meeting their fuelwood needs and why. Determine the productivity and availability of such trees using local and professional knowledge. What practices are followed in caring for and nuturing these species? How different from these present practices would the planting, watering, weeding, fertilizing, pruning, protecting and harvesting of other species be?

- o Consider the degree to which the community can obtain fuelwood from existing wood sources and for how long. Is this source so ample that the fuelwood project will not be supported by individual community members in the long or short-term?

- o Consider the impact of an effective community fuelwood program on the community's need for charcoal production. Would it reduce or eliminate the need for charcoal by providing wood from a nearby source?

- o Anticipate, with the community, its future growth potential and the fuelwood requirements that will result from it. Will this requirement force the rapid development of a large community fuelwood program? Are the requisites for such a program present or should a smaller, less rapid start be made?

- o Develop understandings with the community as to the quantity and type of resources it would be willing to commit to a local fuelwood project and the size project such efforts could support in relation to the community's overall need for fuelwood.

2. To what degree should a community fuelwood project concentrate on conservation of fuelwood as opposed to production?

When faced with fuelwood shortages, many communities focus on fuelwood production or conservation of fuel resources before harvest. (In fact, the "conservation" objective of traditional forestry programs has been overemphasized to the detriment of local people's needs for fuel and related products.) There is little emphasis upon conserving fuelwood after harvest and during use, however, even in donor sponsored fuelwood projects. The primary reasons for this are lack of proven inexpensive technologies that mesh

readily and well with the patterns of fuelwood use in a community, lack of exposure to such technologies by community members, and a lack of understanding about how to introduce new conservation techniques at the community level.

Guidelines

- o Determine the efficiency of the community's use of fuelwood and why particular patterns and techniques of fuelwood consumption are used.

- o Review with the community the social, economic and technical importance of existing heating and food preparation techniques, diets, charcoal kilns and furnaces in cottage industries before considering alternatives that will conserve fuelwood; consider women's needs carefully.

- o Determine the effectiveness of any alternative fuelwood use technologies in meeting individual needs and meshing with existing practices and attitudes.

- o Assess the ecological, social, technical, institutional and economic factors that would constrain the adoption of potential fuelwood conserving techniques or devices.

- o Consider the likely degree of acceptance of any conservation ideas, the cost of introducing such ideas and their impact on fuelwood consumption requirements (as compared to fuelwood production needs without conservation measures).

3. Can a community fuelwood program break the trend toward progressive destruction of wood resources where it is occuring? What kind and scale of program would be necessary?

There are some communities in developing countries where the ecological balance is rapidly deteriorating or has shifted drastically due primarily to fuelwood demands. In such areas, a new system for managing existing resources and replenishing lost ones needs to be put in place. One approach is to use a community fuelwood program. In such an area, however, a community fuelwood program faces a dilemma, particularly if shifting cultivation or nomadic cultures

are involved. The critical lack of fuelwood and its associated economic and ecological problems may be a necessary or highly important factor in motivating a community to undertake a local fuelwood program. On the other hand, pressure on young trees is likely to be severe, and any individuals or groups who cannot be assured of reaping long-term benefits from the managed fuelwood program will keep up this pressure. This will diminish the program's effectiveness unless overall community participation is high and the essential fuel and other needs of all individuals in the community can be met until the fuelwood program reaches its productive stage.

Guidelines

- Explore with the community its fuelwood and related needs, with emphasis on the surrounding natural environment. How does the community articulate and measure the costs it suffers as a result of the degradation of its environment? What does it believe are the reasons for the deterioration?

- Determine what people think needs to change to improve the surrounding natural environment. What do they see as the role of the community in making such changes? What costs do they think will have to be borne and by whom? What is the time-scale of the poor with respect to such activities?

- Isolate specific fuelwood production activities that the community believes are necessary. To what degree would it support such activities? What constraints exist to supporting such activities?

- Determine what species of tree the community would support in attempting to produce fuelwood and improve the surrounding natural environment. Estimate the outline, size and substance of the program that could be effective in dealing with the constraints, needs and environmental conditions faced by the community.

- Explore with the community whether it can effectively embrace, participate in and support such a program. Is some degree of coercion necessary to make the program effective in providing fuelwood and halting the destruction of the surrounding environment?

4. To what extent should community fuelwood programs focus on women as their prime targets?

In many rural communities, women are the principal actors in all fuelwood related activities, from collecting to directing the consumption patterns of the household. Despite their vital role, they have been ignored in the development of many community fuelwood programs in which most of the extension and other program efforts focus on men.

Guidelines

- Determine the activities women undertake in all aspects of the harvest, collection, transport, distribution and consumption of fuelwood. What activities are they primarily responsible for? Do they share any activities with men? Do their activities add to or detract from their status? How do their responsibilities have value to them? Are they interested in retaining them?

- Determine the contributions women could make to planning a community fuelwood project. What special knowledge of growth and harvesting of different species, burning characteristics of different woods, and various uses of wood do they bring? What information about the time necessary to harvest, transport, prepare and burn wood can they make available?

- Determine the support the project would need to integrate women into it effectively. What training of women would be required? Would they need to be freed up from other obligations to participate in training in the project? Could they be brought into special activities such as raising seedlings or serving as a local extension agent? Would they need special transport assistance such as carts? What kind of control might they be given over various aspects of the project? Could they organize the watering, weeding and spraying? Should they determine the means for allocation of wood to various households?

5. Can a community fuelwood program meet the multiple use requirements, including the provision of the desired types of wood, met now or in the past from unmanaged fuelwood land? If not, how can such community needs be met?

Throughout the world, forest and other wood producing areas are used for many purposes, fuelwood production being just one of them. Programs to provide fuelwood must account for the needs of the community for honey, bark, fruit, forage, watershed control and other forest related outputs as well as for specific types of fuelwood to be successful.

Guidelines

- o Assess the various uses to which resources related to or used for fuelwood production now or in the past have been put by the community and the relative social, economic and environmental importance of each.

- o Determine whether a community fuelwood program can be put to the same multiple uses. If not, can the community adjust to the loss of various outputs or obtain them elsewhere? Are they willing to do so or will the program have to include controls to assure that the forest resources are not injured by incompatible uses and pressures?

- o If the community fuelwood program cannot meet the traditional multiple needs requirements of the community, determine who will suffer as a result. Can the program be designed to alleviate any inequitable impact or must it be integrated with other programs to do so?

6. Should community fuelwood programs be designed to meet existing or lesser levels of energy consumption by communities or to provide the energy requirements called for by their future economic growth potential? How can community initiated fuelwood programs account for future energy requirements?

Where fuelwood supplies are becoming or will become inadequate so that a community based fuelwood program is desirable, the anticipated level of fuelwood consumption to be planned for becomes an issue. Most rural villages will depend almost exclusively on

fuelwood for the next 20 years or more. The impact of their economic growth on future fuelwood consumption is especially relevant, particularly where the population or rural industrial activities that would use firewood or charcoal are expected to increase. The degree to which community fuelwood programs can cope with such needs, the degree to which they do consider future energy requirements and the extent to which a community should continue its dependence on fuelwood are important to communities, host governments and donors. In fact, community fuelwood programs tend to arise out of crisis; consequently, they are usually too little and too late. Moreover, the obvious objective of most of them is to maintain the status quo (or the immediate past) in terms of consumption and the environment, despite the importance of focusing on future needs. Given such circumstances, the issue raised is whether a community fuelwood program is or can be a complete answer in light of the community's future energy needs, and if so, for how long.

Guidelines

- Assess overall community energy requirements over time, perhaps with reference to case studies of the historical energy growth of reasonably similar communities that have already passed through the economic development stages facing the community under study. What do individual community members expect in terms of future energy requirements?

- Determine the past and likely future degree of dependence of the community upon fuelwood for its economic growth. Are there handicrafts or rural industries that depend on fuelwood; is there potential for more? What are the population (and migration) trends of the community? To what degree will future community fuelwood requirements be the result of international market phenomena (tobacco exports, fossil fuel prices, etc.) or market forces within the country but outside the community?

- Estimate the size of the community fuelwood program necessary to meet future energy requirements. Is it so large that its successful organization, management, etc., is questionable? What are the implications of such a conclusion for the program? For fuelwood conservation? For the development of alternative energy sources?

For the future economic growth and quality of life of the community? For the ecological balance around the the community? Is a more massive fuelwood program than the community itself can support necessary and possible?

- o Determine when the community fuelwood program must be launched to account for the community's future energy needs. Is there community understanding and support or pressure for starting a large enough program in time? If not, can the community be helped to understand the need for such action? How much "help" can be given the community without losing effective participation of community members in the program?

- o Estimate how economical a fuelwood program would be today and in the future. How are individuals affected in terms of current costs and returns if they participate in the fuelwood program? Is there an economic rationale for such a program that community members can understand?

7. What socio-economic significance should be attributed to community controlled firewood resources as compared to energy from sources outside the community -- fossil fuels, hydroelectric or solar equipment? What are the effects on the fabric of the community of loss of control over its primary energy source?

Community fuelwood programs can be aimed as much at social and political objectives as at technical and economic ones. One issue is whether community control of its primary energy source is important in off-setting detrimental impacts of dependence upon energy or energy devices imported from outside the community.

Guidelines

- o Assess the behavior and attitudes of individuals in communities that control their fuelwood supply in contrast to those dependent upon outside energy sources. What are the risk aversion, economic and social impacts in each case? How do the individuals at different income levels who are affected by each situation feel about energy, their life style and the security of their energy future?

What values, attitudes and products are imported into the community along with fossil fuel or other sources of energy?

- o Explore whether individuals do, or are willing to, spend as much in assuring adequate present and future fuelwood supplies as they spend or are likely to spend in obtaining alternative energy sources.

- o Consider with community members whether alternative energy sources are valued and why. Are they valued for social or economic reasons? To what degree will they displace fuelwood if its price begins to rise? Is the significance of fuelwood primarily that it is mostly a "free good" rather than its control by the community? Would the introduction of alternative energy sources further stratify the community economically and socially? How would the poorest be impacted?

8. How can rapidly escalating demand for firewood and charcoal in urban areas be reconciled with the growing requirement of firewood and charcoal in rural communities? How do rural communities take account of this conflict?

Guidelines

- o Encourage rural communities to identify ways in which the urban sector can finance the development of firewood and charcoal production to meet not only its own needs, but also the need for fuelwood and jobs in rural communities.

- o Provide afforestation programs in or near urban areas that meet the fuelwood needs of the urban sector, thus relieving demand and price pressures on rural community firewood and charcoal resources. Combine this with an equitable distribution of alternative energy sources between urban and rural areas.

- o Develop appropriate charcoal conversion technology for the urban sector that conserves existing wood resources in both urban and rural areas.

- Encourage villagers to undertake commercial charcoal programs (including wood resource production) to supply urban markets.

9. How will a community fuelwood program affect the overall energy balance in the community?

A community fuelwood program interacts with all other energy sources within a community. The use of crop residues, dung, grass, petrol and other fuels will be affected by the program in both the short and long term. Understanding such interactions is important to an overall and fair assessment of the energy costs and benefits of the program.

Guidelines

- Assess the energy system of the community with special emphasis on the ways various forms of energy are integrated with the routine of community life. Where do people in the community get their energy and how and for what purposes do they consume it? What role does fuelwood play in the system?

- Introduce a community fuelwood program scenario; how is the community's energy system likely to be impacted? Will it reduce the use of dung or crop residue as fuel? Will this reduction decrease the use of chemical fertilizers for crops or increase crop yields? Will the program require more gasoline for motor saws, trucks or to transport extension agents? More fertilizer for the trees? How will it affect the mix of charcoal and firewood used in the community?

- Explore possible changes in the energy balance with individuals in the community to uncover special problems related to the changes. Will charcoal producers suffer? Will farmers avoid participating in the program because they have dung and crop residues to burn? Can the program be designed to avoid these and similar problems?

10. How do community fuelwood programs affect migration of villages or individuals? Under what circumstances will such effects be most pronounced?

Some villages have been forced to relocate due to fuelwood shortages. Individuals have been forced to migrate, or shift their harvest of wood to nearby marginal lands because their access to fuelwood was cut off by the conversion of land to private ownership or by more rigid enforcement of existing access regulations. Thus, the impact of community fuelwood programs on migration can be beneficial or detrimental, depending upon location-specific circumstances.

Guidelines

- Determine the source of fuelwood supplies for each category of individuals in the community. How will this source be affected by the program? Will individuals or groups be partially or completely cut off from traditional fuelwood supplies?

- Identify sources or means for providing individuals who would lose access to their fuelwood supplies because of the program with needed fuelwood or other energy supplies. Can they obtain supplies elsewhere? Alternative fuels? What can be done to help the poorest until the program begins to provide fuelwood?

- Determine whether anyone has migrated from the community primarily because of lack of fuelwood. Will a community fuelwood program alleviate such a tendency or exacerbate it?

11. What special problems are faced by remote villages in trying to develop a community fuelwood program?

Remote villages have fuelwood problems too, and in many ways, community fuelwood programs would seem particularly well suited mechanisms for helping solve them. The fact is, however, that remote villages have less chance of using the mechanism than their more centrally located counterparts.

Guidelines:

- o Determine the components of a community fuelwood program desired by the remote village. How many can be provided by the villagers? Which group or agency is to provide the remainder -- the local government, the Forest Service, the Ministry of Rural Development, etc.? How far are such groups or agencies located from the village? How often is the village visited by an extension worker? How far away is a needed tree nursery or an expert on tree diseases?

- o Assess the extra degree of government commitment needed and by whom -- low level officials, etc. -- to support the remote village as compared to its more accessible sister village. Has the government effectively supported other programs for similar remote areas? Is the government likely to reap political visibility or other benefits from supporting the remote village?

12. How can community firewood needs be reconciled with competing requirements for industrial timber for domestic use or export from indigenous forest land or land converted to forest plantations? What is the role of the community in reaching an accommodation among these competing objectives?

Industrial timber development and management creates both problems and opportunities for communities near such timber sites. Creation of industrial timber plantations may wipe out indigenous fuelwood supplies for one or several communities. Once industrial logging begins, however, forest and sawmill waste may be a fuelwood bonanza for nearby communities. Where plantations are not the rule and industrial timber, whether managed or not, is interspersed with other trees and vegetation, the potential for accommodation between communities and commercial timber interests is usually present, sometimes resulting in complementary results for both. A larger issue is how to accommodate these competing interests when they conflict on a national scale. Timber resources are a major source of foreign exchange in some countries, a factor that sometimes overrides fuelwood needs of rural communities.

Guidelines

- o Determine the potential for agro-forestry in areas where unmanaged land is used to produce lumber or is to be

shifted to commercial timber species. Can local animal and crop agriculture, fuelwood and timber interests be accomodated? Will all the interested parties cooperate? What traditional community practices would have to be altered? Who in the community would lose or gain as a result? Who will "control" the agro-forestry system; what role and authority will the community have?

- o Where agro-forestry is not practical and forest plantations are to be developed, assess the potential for providing a community with temporary sources of energy until its fuelwood needs can be supplied from the managed commercial forest. What sources of energy are available? At what cost? Who pays? How will the community be affected? What role will it have in determining the price, quantity and source of the alternative energy supplies? When the commercial forest matures, what kind of wood will the community get from it? What access will the community have and who will control it? At what price? Over what period of time? How much distance and time will be involved in obtaining the wood?

- o Assess the possibility of relocating the village or developing alternative energy sources where commercial afforestation wipes out a community's available fuelwood supplies. What impacts would each have on the community? Which group or groups in the community would lose the most and why?

B. ISSUE: What Type Fuelwood Program Best Meets A Community's Needs?

Community fuelwood programs take several forms ranging from private or village woodlots that are fairly well isolated from other community needs and activities to fuelwood programs that are highly integrated with the overall rural development needs and potentials of a community. This major issue acknowledges the many needs of most communities and focuses attention on determining the type of fuelwood program that can best meet them. Subsidiary issues are presented below. Guidelines to be followed in answering each question in the context of a particular community are presented following each question.

1. What are the needs of the community that will be affected by a community fuelwood project including, but not limited to, its fuelwood needs?

One of the necessary conditions for a community fuelwood

program is that it be compatible with and meet as many of the multiple needs of the community as are feasible. Thus, the needs of the community should determine the shape of the fuelwood program.

Guidelines:

- Identify, with individuals in the community or by survey, the primary needs of the community. Which needs relate to energy or the existing fuelwood base -- land, trees, vegetation, etc.? Does the community satisfy several needs from the existing fuelwood base? What are these needs? Are they being fully or partially met? For all, or only some individuals? How much longer can the needs be met given the present or likely resources devoted to meeting them?

- Determine how much of the existing fuelwood base might be affected by a community fuelwood program. What community needs would be affected by such a program? Are there any needs that would no longer be met if certain community fuelwood programs were initiated? Who would be affected?

2. Would a community fuelwood project that includes agro-forestry or is integrated into a full-scale rural development effort be more effective than a project that solely meets a community's fuelwood needs?

Community fuelwood programs must be supported by the community and all relevant levels of government; they must also receive adequate resources over time. To obtain enough land and other resources for the needed program, it may be necessary to introduce new agricultural techniques that will enable food to be grown on less land, thereby releasing land to be used for fuelwood production. Thus, to solve the fuelwood problems facing the community may require a much more comprehensive approach than simply producing more fuelwood alone.

Guidelines

- Determine the basic needs that can be met by a fuelwood program devoted exclusively to providing firewood or charcoal. Are the benefits of such a program sufficient to outweigh other priority needs displaced by it? Can it attract sufficient resources without necessitating major changes in production or consumption of other products or services by the community?

- Evaluate the range of needs that could be met by an appropriate agro-forestry type community fuelwood program. Does the wider range of benefits from such a program better meet the community's needs? Is the added complexity of such a project offset by its expanded benefits? Would the additional costs and benefits be equitably distributed within the community?

- Assess the range of needs that could be met by a comprehensive rural development program that includes a fuelwood project as one of its integrated components. What additional needs could be met by the fuelwood project within such a context? How important are they to the community? What degree of complementarity exists between the fuelwood component and other components? Is such an effort necessary for the fuelwood project to be successful? How extensive are the changes that the community must make in its current socio-economic system to successfully meet its future fuelwood requirements and how extensive must a rural development program be to enable the changes to be made successfully? What are the major advantages and disadvantages of integrating a fuelwood program with a major rural development effort? Does such an overall effort enable the initiation of a community fuelwood program earlier in the cycle of fuelwood scarcity and crisis than would otherwise be the case? Does it enable a fuelwood program that, by itself, would be of low priority in the light of other competing needs and goals to be more successful? Does an integrated rural development approach attract more overall community and governmental resources and support for a fuelwood program than the program would attract if it stood alone? Does it enable a fuelwood program to contribute more broadly to meeting overall community needs such as environmental quality, economic development, self-sufficiency and economic and social equity among various income groups?

C. ISSUE: How Can Community Fuelwood Programs Encourage Broad Scale Local Participation?

There is usually not a strong tradition of managed forestry or fuelwood at the community level in developing countries. Thus, even where fuelwood has become scarce, rural people often continue to place current needs ahead of long-term needs in dealing with whatever fuelwood supplies are available. Successful development

of community fuelwood programs depends upon broad scale participation by all or nearly all of the members of the community. Otherwise, the trees of one person are destroyed by the animals of another, wood tended for years by one is used by another, etc. Encouraging such participation is partly a matter of providing adequate incentives to such individuals to participate or helping them understand why their participation is beneficial and necessary.

1. Where substantial afforestation efforts are necessary to meet community fuelwood needs, what can the community contribute, what forms does such a contribution take, and what factors determine the success of such contributions?

Community fuelwood projects assume contributions of labor and other resources to the project by individuals in the community. The magnitude and nature of the contribution depends on local circumstances; project resource requirements that cannot be met by the community (e.g., credit, research) must be drawn from other sources.

Guidelines:

- Consider with people in the community the resources a project would require and the resources they would be willing and able to contribute. Where are such resources allocated now? Would shifting them to a planned fuelwood program affect productivity in other sectors, such as agriculture? How? Are there resources available that the community will not contribute? What is the reason: lack of concern about fuelwood compared to other needs, lack of participation, unclear goals regarding the future allocation of benefits, etc. Under what circumstances would the community increase its contribution of resources to the fuelwood project?

- Identify resources for the project that would have to be provided from outside the community. Where can they be obtained, and at who's expense? Is the benefit to be obtained from resources contributed by the community dependent upon the non-community resources? To what degree? Can any of these outside resources be supplied by the community? How soon? At what cash cost and at what opportunity cost?

2. Under what circumstances do people participate in community fuelwood programs?

Effective, broad scale participation in community level fuelwood programs depends on numerous factors, but some are more central than others.

Guidelines:

- o Determine what people want from a community fuelwood project and the degree to which they desire to participate in its planning. How can they be given a well understood stake in the output of the project; in its management as well as in the labor, etc., required? Do all the people in the community understand the project and the behavior required of them with regard to it if they are to benefit? Are their future benefits from the project assured for them and do they know it? Are tenant farmers assured of benefits if they improve the fuelwood production on their rented land? How are the landless affected? Can the poor afford to forego current consumption needs to allocate resources to a long range fuelwood program? Are they certain to receive the anticipated benefits?

- o Determine the activities that could be undertaken by the community and by different levels of government. Is there a clear understanding by the community people of their role in the fuelwood program? Is the government's role understood by it and by the people in the community? What is the process whereby people can get involved in the project or program?

- o Identify, together with people in the community, any groups or individuals which might find it hard to participate in the program. How can the needs of such persons be met? Can incentives be used? Is some form of coercion necessary and, if so, by whom?

- o Determine circumstances under which larger groups of people could effectively participate in the project or program. Is a "top-down" approach to community fuelwood programs necessary or acceptable, for example, to deal effectively and rapidly with areas experiencing

critical fuelwood shortages or ecological problems? Can community people initiate programs to deal with such problems, and will there be adequate participation? Where such problems exist, whose interests are overriding, the people's in the village affected or the state's? How do government goals tie in with community goals regarding participation in fuelwood programs? Does the government expect community contributions and participation on its terms or according to the expressed desires of the villagers?

3. How can traditional knowledge of tree growing, forest management, and fuelwood consumption technology be utilized in community fuelwood programs?

Residents are a primary source of information about all aspects of fuelwood in rural communities. Often, however, their knowledge is never tapped because project managers do not respect local experience and because exotic species or other imported technologies are being used which are "not understood" by the villagers.

Guidelines:

- Study fuelwood related practices in villages to identify useful knowledge and skills, and equally important, to identify local leadership. This requires foresters trained in social science who are sensitive to local attitudes and the possibilities of indigenous species.

- Work with local people to base community fuelwood program structure and technology on existing capabilities and social priorities (e.g., to preserve existing local forest plots and land management regulations wherever appropriate according to the community).

- Analyze the potential to apply existing technical skills (from agricultural, small manufacturing, and other practices) to energy-related matters such as stove construction and charcoal production.

- Allow for and encourage expression and initiative on part of villagers, especially by women.

4. How can the participation of women in community fuelwood programs be encouraged?

Women play a vital role in most fuelwood activities in rural areas of developing countries. Despite this central role, they are often relegated to providing only supporting assistance to men in community fuelwood programs. Thus, they cook the meals and carry the water while the men plant, weed and harvest the wood. Also, they often do not find it easy to contribute knowledge and ideas to the community fuelwood effort.

Guidelines

- Evaluate the total time budget for women in the community. Where can changes be made that will release time from other activities for use in the fuelwood program? E.g., would a mini-maize mill in the village reduce the time women spend pounding corn? What activities are women doing they would like to give up to be more involved in the fuelwood program? Or, is it best to let men, whose time may not be totally absorbed anyway, undertake most of the fuelwood project tasks?

- Determine the incentives women might respond to in considering more participation in a fuelwood program. Is the prospect of more accessible fuelwood closer to home an adequate incentive? Would related incentive programs such as health care, a water tap, more education or additional training result in more participation? If women could be given a central role with authority over some aspects of the program would it induce greater participation? What impact might high level encouragement or a national campaign for women and/or fuelwood have on the involvement of women? Would competitions between women's groups or villages encourage women's participation? Would provision of specific inputs such as a cart for transporting wood reinforce women's involvement?

- Evaluate the prospects for existing forms of village organization that heavily involve women to enhance their participation in the fuelwood program. Are any women's groups in existence? What is their function, organization and strength? Does women's involvement in fuelwood production fall within their purview? What role might each group play in involving women in the fuelwood project? Are any women involved with village committees, the village council or similar quasi-official groups? Can they be helpful in apprising women of the benefits of the program? Are there any women of status, either socially or professionally, who might encourage women to participate in the program? Are there men who champion an expanded role for women who could help involve women in the fuelwood effort?

5. Where should local control be vested in community fuelwood programs and why?

A substantial degree of local control over community fuelwood programs is widely accepted today. Sometimes, however, the relative merits of different sources of local control are overlooked.

Guidelines:

- o Determine the sources of local authority at the community level and their relationship to different socio-economic groups in the community. Where do various community members want local authority for the fuelwood program to be vested? Why? Can several sources of local authority control the project together? Will local elites control the program for their own benefit? Will the fuelwood needs of the poor be more likely to be met from the project if certain local authorities control it?

- o Assess the likely areas of conflict between the requirements of the fuelwood program and of other activities in the community. Can one local authority balance such competing interests better than another?

- o Determine the importance of charcoal in the community, or in nearby urban centers. In that charcoal production is usually carried out by specialists and commercialized, is there a mechanism for division of labor and product that would enable a major community charcoal component to succeed? What would the mechanism be? Which local authority is best situated to develop or monitor such a mechanism?

6. How can fuelwood production work be made more attractive to rural communities?

The use of community based labor and other resources is critical in developing and managing community fuelwood projects. Incentives that will motivate such labor (and other necessary participation) despite the fact that the output from the trees produced will not meet immediate needs, must be present as a part of the project.

Guidelines:

- o Determine the benefits from tree growing (not just from land management in general); make them clear to villagers through stabilization and enhancement of fuelwood supplies as a fundamental component of community forestry projects. Would special programs such as annual compensation for deferred crops, special loans, etc. help encourage fuelwood production work?

- o Allocate specific tree stands as community or individual property for fuelwood and other use.

- o Provide suitable compensation to workers for their activities and for growing any trees that they will not be able to use for fuelwood.

- o Adopt community fuelwood programs that do not compete with other peak demands for labor such as agricultural harvesting.

- o Encourage the use of labor in the program according to existing labor use patterns in dealing with fuelwood. What is the role of women? Children? Do families cooperate in fuelwood activities?

- o Study ways in which forestry work can be made less arduous and hazardous and implement whatever safety and health procedures are possible to achieve such results.

7. What constraints affect participation in community fuelwood programs?

Participation in community fuelwood programs ranges from a herder protecting new trees from his grazing animals to planting, cultivating and harvesting trees. Constraints on such participation are many, especially when larger amounts of resources -- time, money, land, water, etc., -- are involved; overcoming them is an important part of the project design and implementation process.

Guidelines:

- o Determine competing labor and other resource requirements affecting different groups and individuals in the community. What priority is given to fuelwood? Has

this priority changed over time and can it be expected to change in the future?

- o Assess the current employment situation, noting social, economic, and seasonal demands for specific work, as well as competing demands for labor from growing urban sectors. Do labor allocations to various uses change from season to season within the same year? What specific time and skill requirements are required by existing fuelwood activities? By a community fuelwood program? Are there any long-term effects of national development plans on village level labor availability that should be taken into account?

- o Identify the social status given different tasks in the community, including fuelwood related activities. What status does the community accord to work related to various fuelwood activities? Who carries out the fuelwood related tasks? men? women? children? people from certain socio-economic groups within the community?

- o Identify particular difficulties, dangers and hardships of forestry work itself and determine their impact on discouraging participation on such work.

D. ISSUE: What Resources Do Community Fuelwood Programs Require?

Planned fuelwood production at the village level requires certain resources, most of which are already being used elsewhere. Identification of the resources required, who will supply them and what other village activities will be impacted by using them for fuelwood production is an essential step in understanding and supporting community fuelwood programs. Information about the socio-economic context of fuelwood use in rural communities is important in making this identification possible.

1. How can the attitudes and behavior of the members of the community be drawn upon to enhance the effectiveness of a community fuelwood program?

The local human factor and human capabilities are the resources most central to a community fuelwood program. Most of

the attitudes and behavior of community members are more of an asset than a constraint to the effectiveness of a community fuelwood program. To the maximum degree possible, they should be drawn upon rather than disregarded, dismissed or "scheduled" for change.

Guidelines:

- Determine the local attitudes about various aspects of fuelwood and the resulting behavior of individuals in the community. What attitudes and behaviors are especially supportive of various aspects of a community fuelwood program? How can the program build on these attitudes and behaviors? Are there any attitudes or behaviors that must be offset by the program? Are individuals in the community aware of these behaviors and are they willing to change them? Can the community fuelwood program provide effective incentives or other assistance to help change these behaviors?

- Compare the attitudes and behaviors of various community members about fuelwood with those of extension workers and others outside the community who would also be involved in the community fuelwood program. Are there substantial differences that will impact on the program? Which set of attitudes and interests would supercede the other? What impact is such a difference likely to have on the program? What changes in the attitudes or behavior of various actors would benefit the community fuelwood program (extension workers, village elders, government policy workers, etc.)? How might such change be achieved, and how long would it take? Do community members support efforts to help make such changes?

- Identify the kind of human resource contributions available in the community and compare it with the needs of a community fuelwood program. Is there a substantial gap between available human skills in the community and those needed? Can the skills of the local community be upgraded in time to supply more of the human resource requirements of the project? Are skills not present in the community available to it from other sources? At who's expense? How much competition is there for time and labor and requirements between food and cash crops and the fuelwood program? How can such competition be reduced?

- Assess how a community fuelwood program would impact upon human resources now used for fuelwood production, harvesting and marketing. What is the attitude of those impacted? Will the program reduce the weight, volume, distance and frequency of trips for fuelwood made by community members? Will a decrease in the distance and frequency of trips increase the consumption of fuelwood in the community? How will a community fuelwood program affect the harvest technology used by the community? Will it affect rural industrialization or off-season agricultural employment by releasing more labor for other uses? Will the program overcome natural barriers to fuelwood harvest and transport? How would a community fuelwood program affect the social factors now involved in collecting fuelwood?

2. How can competing pressures for use of land that arise in meeting community fuelwood needs be dealt with and by whom? Can the community resolve this issue alone or does its resolution usually require government intervention or support?

Land is a critical resource needed for community fuelwood programs. It is also essential to the agricultural production needs and many other requirements of the community. A community fuelwood project will succeed only if it does not excessively reduce the land base available to the community for meeting all its other needs.

Guidelines:

- Determine the land base of the community and competing claims for it. Is there a general scarcity of land in the community? Is marginal land available that can be allocated to fuelwood production without unduly affecting crop, livestock or indigenous fuelwood production? How will a program affect the overall agricultural productivity of a community (leaving dung and fodder to crops and livestock, releasing time for agricultural tasks, removing labor, land from agricultural production)? What other uses of land can be combined with its use for fuelwood production? Will the initiation of a fuelwood program strain land availability so severely as to threaten the success of the program? Can agricultural

programs enhance the productivity of land, thereby releasing some for fuelwood production? What non-traditional sources of income might enable community members to release more land from agriculture to fuelwood uses?

- o Determine what lands might be used for a community fuelwood project. Is satellite imagery available for use? What map and survey data is available? What are the feelings and attitudes of villagers toward the use of various land areas for fuelwood production? Who should select final sites for woodlots? Who can speak for the poorest, women, etc., regarding such site selection and adequately represent their interests?

3. What land tenure and ownership patterns are most conducive to effective community fuelwood programs?

Land tenure and ownership patterns are an important determinant of access to managed and unmanaged fuelwood lands. The relative security felt by those with rights to use land also influences their willingness to invest in land-based programs such as fuelwood that have long gestation periods.

Guidelines:

- o Determine the types of land tenure and ownership patterns in the community and the characteristics of each. Are some more conducive to managed fuelwood efforts by individuals or the community than others? Where land tenure is not secure enough to encourage individual long-term fuelwood production and conservation activities (e.g., with tenant farmers), what community level efforts can be used to achieve the desired results? Will the existing tenure and ownership patterns allow equitable distribution of the project's output?

- o Identify the characteristics of the community fuelwood program most compatible with the land tenure and ownership patterns of the community. Is such a program also compatible with other community constraints (e.g., labor availability)? Does it meet other community goals -- conservation, agricultural production, etc.?

4. What special resources can women contribute to a community fuelwood program and what assistance do they require to make such a contribution?

Women have been intimately involved in the collection and use of fuelwood for thousands of years, often to the complete exclusion of men from this activity. It is more than reasonable to assume that they have a substantial amount to contribute to any community fuelwood program.

Guidelines

- Determine the various resources women possess that could be applied to the planning, implementation and management of a community fuelwood project. What relevant knowledge do they possess about the characteristics of indigenous trees, their growth patterns, care and protection etc.? About the fruit, nuts, bark, spices, gum, vines, and leaves of various species? About the drying characteristics of each kind of wood? About the vulnerability of various species to insects, disease, animals, lack of water, etc.? About the way each type of wood burns? About how to best cut, split and carry each kind of tree? What cooperative skills do they possess? Can they organize wood gathering parties? Are they able to communally work together, sharing the total product satisfactorily among themselves? How much administrative skill can they provide? What kind of time and energy do they have available? How could it be used to support fuelwood project activities?

- Consider ways that the resources of women can be applied to the community fuelwood program. It is feasible to involve women in any planning and implementing groups? If not, could women's advisory groups be set up to support the project? How could such advisory groups pass along women's special knowledge and provide an outlet for women's administrative skills and time and energy? Can they, or other groups, enable women to play an active role in the planting, weeding, fertilizing, thinning, harvesting and transporting activities? Are there any "special niches" where women's capabilities can be used without directly threatening an established cultural pattern -- e.g., establishing backyard nurseries to provide tree seedlings for the program; making the clay pots used to contain trees in some programs, etc.

5. If charcoal is to be an important aspect of a community fuelwood program, how does it change the species, management, time phasing, economics and community involvement of the program? How would such a program alter the existing charcoal industry (trucks, middlemen, etc.)?

Charcoal production, distribution and consumption is unique in numerous ways as compared to firewood. The introduction of charcoal into a community fuelwood project may alter many aspects of the project substantially. Thus, consideration of the socio-economic and environmental aspects of charcoal use in the community becomes an important part of any community fuelwood project based wholly or partly on charcoal.

Guidelines:

- Determine the production, distribution and marketing aspects of charcoal (and firewood) production in the community. Is charcoal an important fuel for the community or nearby urban areas? How will a fuelwood program affect the production and consumption of charcoal by individuals in the community? Will it reduce charcoal supplies to the urban market? What impact would such a reduction have on the program? Is there a need for a charcoal component in the community fuelwood project?

- Identify the components of the community fuelwood program needed to include both firewood and charcoal. What aspects of a purely firewood program change as a result? How much more difficult is such a dual program to manage for the community and various supporting government agencies? Who in the community would benefit from the charcoal component? Would the charcoal from the project supply individuals in the community or urban areas? Is charcoal production necessary to meet the community's future energy requirements as a result of rural industrialization and other economic growth?

E. ISSUE: What Are the Management Requirements of Community Fuelwood Programs?

Effective management of a community fuelwood program is vital to its success. Such management involves control of access, provision

of technical support, allocating project outputs and many other tasks. It is usually carried out at several levels, -- individual, community, central government, etc. The most significant management tasks are usually at the community level, but it varies by project.

1. What are the most effective ways to control access to community fuelwood resources?

   Guidelines:

   - o Identify existing modes of land tenure and the restrictions they impose on access to fuelwood. Pay particular attention to existing legislation regarding ownership and transfer of lands and to whether trees or forest are treated differently than agricultural lands.

   - o On lands held under public or communal tenure, demarcate clearly the boundaries of community holdings. Use surveys and local administrative bodies (clans, chiefs, councils, etc.) to assess local needs and develop regulations concerning individual and/or family shares in fuelwood. Participation in fuelwood nurturance should lead to greater individual benefits.

   - o On privately-owned lands, establish and enforce regulations limiting destructive cutting and requiring the establishment of fuelwood stands. Provide general guidelines for fuelwood conservation and development, with villagers providing suggestions as to suitable lands, levels of supply desired, and how enforcement should be conducted. A planning body could set penalties for violations of regulations and rewards for compliance.

   - o Consider modifications to existing land tenure systems and regulatory access systems that would achieve a better managed and more equitable usage of fuelwood resources.

   - o Determine which source of authority should control access to community fuelwood supplies. Is the regulation of access to firewood and charcoal wood limited or ineffective? Is this a result of ineffective government or of the knowledge of the political repercussions and economic hardships that would

result if the regulations were strictly enforced? Has there been a general decrease in the political power of the community (as a result of central government activities)? How has such a trend affected local control over exploitation of fuelwood resources? Can traditional local control of access to firewood which is effective be translated to the community fuelwood program? How do fuelwood conservation or access limitation plans affect the poorest? Women? The old or handicapped?

2. What technical and institutional management systems are necessary for community fuelwood programs to be successful?

Guidelines:

- Determine the technical support necessary for the community fuelwood program. What is the role of extension in the program and what special training requirements are needed to enable extension workers to play such a role? Should extension workers be men or women, or both? What fertilizer, pesticides, equipment and related technical inputs are necessary? Are there "efficient" charcoal production processes that can be economically and effectively used by small scale charcoal burners as a part of the project? What are they?

- Is there a optimum size community fuelwood program for firewood and for charcoal production?

- Determine the institutional support necessary for the community fuelwood program. What kinds of protection of community fuelwood lands are necessary and how can they be achieved? What means of allocating labor and production can be effective? Will the community support such an allocation system? What specific commitments are needed for a community fuelwood program from government at all levels and how can such commitments be assessed for credibility?

3. To what degree should women be involved in the management and control of community fuelwood programs?

Guidelines:

- o Conduct surveys to identify women's role in fuelwood growing, harvesting, and consumption and women's role in the community social and political decision making process. What is the attitude of various individuals in the community about the use of women foresters and extension agents? Would their use affect the success of the program? In what way?

- o Seek to include local women (as much as is possible under local social and political constraints on women's activities) in the planning of community fuelwood programs.

- o Seek to preserve women's traditional areas of participation in fuelwood activities under new programs (e.g., if women are the fuelwood gatherers, they should probably remain fuelwood gatherers. They, not men, should be taught new gathering methods and collection management. If they built traditional stoves, they should be taught to build improved stoves. If they plant trees, they should be taught new tree planting techniques, etc.). Can their participation be expanded?

4. To what extent would a community fuelwood program commercialize fuelwood production, harvesting and marketing?

Fuelwood is or was a "free good" in many rural communities in the developing world. Yet, the result of many community fuelwood programs is to further the commercialization of the fuelwood system. The need to measure and allocate fuelwood program benefits encourages such a result as does increasing scarcity of fuelwood in some areas. In planning a community fuelwood program, the degree to which it would extend commercialization and its impact on various groups within the community, especially the poor, landless and disadvantaged, should be analyzed.

Guidelines:

- o Determine the current degree of commercialization of

fuelwood and the increase or decrease expected as a result of a community fuelwood program. What effect will such changes in commercialization have on who receives fuelwood in the community? From the program? Would the sale of fuelwood from community woodlots (if any) result in equitable distribution of fuelwood or must other social allocation systems be used? Are community fuelwood programs more likely to succeed where there is a large and active market for fuelwood nearby to highlight the need for and value of fuelwood?

- o Assess the socio-economic merits of deliberately commercializing charcoal production where it is a major part of a community fuelwood project. How many individuals are or will be involved in producing charcoal under the program? Do villagers want to produce their own charcoal or would they rather buy it or provide their share of community fuelwood to specialists and receive a portion of the charcoal produced by them instead? If charcoal production is commercialized, how do non-charcoal producing people in the community feel about their participation in the charcoal aspect of the program?

F. ISSUE: What Are the Benefits and Costs of Community Fuelwood Programs?

Balancing the benefits and costs of community fuelwood programs and assuring their equitable incidence is a central consideration in designing and implementing a program. If individuals conclude the costs they incur as a result of the program are greater than their benefits, they will cease to participate. Or, if they believe they suffer disproportionately high costs or low benefits relative to others in the community, they will also stop their cooperation.

1. What concrete improvements in individuals' lives can be generated by a community fuelwood program?

The objective of a community fuelwood program is to make concrete improvements in people's lives. The primary improvement is an adequate and stable supply of fuelwood, but fodder, fruits, nuts, resin, honey and beeswax, shade, windbreaks and soil conservation may also result from such programs. Such benefits should

come as soon as possible, especially when the program is central to the lives of individuals in the community so that its performance is highly visible and important to them.

Guidelines:

- o Determine the concrete improvements in the lives of various income groups in the community that are likely to result from the fuelwood program. How soon will these changes be generated? Who will receive the benefits? Is there a need to devise ways to distribute the benefits more equitably? What influence does scarcity of fuelwood have on the foods produced for consumption? What are the nutritional implications of a shortage of fuelwood or an increase in its price that leads to a decrease in the amount of cooking that can be done? Will the community fuelwood program reduce such problems? What fuelwood and land conservation aspects can be generated by the program? Will the program increase the use of firewood and/or charcoal by the community? Will rural industrialization be encouraged by it?

- o Assess the degree to which participants in the community fuelwood program benefit from their efforts. Are agricultural opportunities and social facilities offered to community forestry workers? Do some or all of these benefits contribute to meeting the basic human needs of the participants? Do they lead to long term improvements in standards of living? How important are such benefits to program participants and over what time frame?

2. At what point(s) does a rural community begin to adjust socially and organizationally, rather than economically, to alleviate the rising costs and disruptions of fuelwood scarcity? What forms does this adjustment take?

Fuelwood scarcity has social and organizational impacts on a community as well as economic and environmental ones. The latter have received more attention than the former, perhaps because they are easier to identify and document.

Guidelines:

- o Identify any social and organizational aspects of a community that have changed as a result of fuelwood scarcity. How does shortage of firewood affect significant cultural aspects of the people--cremation, ceremonial fires, availability of local beer, pottery? Are more people cooking together, or cooking and heating less? Are ceremonial dinners being abandoned? Have individuals, families or villagers migrated so as to be better able to find firewood?

- o Determine how a community fuelwood program could help arrest such changes. How soon can fuelwood be supplied to the community? What is the pace of the social and organizational adjustment of the community? Are there temporary solutions to the fuelwood scarcity problem until the project begins to produce?

3. How can the rapidly growing demands for firewood and charcoal in urban sectors be satisfied without endangering firewood and charcoal availability for rural communities?

Guidelines:

- o Determine the point(s) at which rural and urban firewood and charcoal users adjust their consumption levels of fuelwood downward. What causes the adjustment and what forms does the adjustment take? Does conservation of wood resources increase, thereby lowering consumption? Will a community fuelwood program enhance or reduce the access of nearby urban areas to fuelwood? Will it increase or decrease the amount of charcoal used by the rural community? The nearby urban community? How can rural communities shift the ecological costs of producing charcoal in rural areas for the urban market from themselves to the urban sector?

- o Consider new fuelwood supply sources in areas close to (or within) cities through reforestation programs manned by urban-based workers. These supply centers would produce firewood and charcoal (through the establishment of neighboring cutting and charcoal conversion facilities, also manned by urban workers) which would then

be transported to urban markets. Is adequate land available? What are the costs and benefits of the program as compared to alternative energy systems?

- o Examine the potential of more energy-efficient charcoal conversion devices to reduce firewood consumption by urban areas. Develop technical assistance and extension programs to implement these more efficient devices. The success of such programs will depend on the incorporation of village-level inputs into the design and development of the devices themselves.

4. How can the costs of establishing community fuelwood stands that will not yield product for years to come be offset?

   - o Explore the potential for government subsidies, loans, tax credits, alternative wage employment, etc. to provide financial support to individuals until the fuelwood project begins producing. Can one or a combination of these offset the current costs of the fuelwood program for an individual? Can individuals be compensated for the opportunity cost of the resources shifted to fuelwood production during the early years of the project?

   - o Determine whether fuelwood cultivation can be organized so that food or cash crops can be grown on tree lands during the early growth years of the project, or to take advantage of the benefits of increased agricultural productivity and non-agricultural income sources introduced by a rural development program.

   - o Investigate the use of fast growing species, whether exotic or local, that will give earlier economic returns. Are such species adapted to the community area? What changes in traditional fuelwood practices do they require? Can they be used alone? Mixed with local species?

5. How can the costs and distribution of fuelwood from a community based program be controlled to assure its availability to low-income users? Do community programs account for such users while national programs do not or vice versa?

There is little in the way of special provisions for the poor in traditional fuelwood systems; in most areas, however, fuelwood is free and self collected so that the poor can obtain as much in the way of supplies as those with higher incomes. A community fuelwood program may introduce increased or cash fuelwood costs for program beneficiaries; it may, on the other hand, reduce costs below those in the traditional system by saving time and labor, etc. Where it introduces increased costs, the need to assure supplies to the poor at prices they can pay becomes important.

Guidelines:

- Determine the likely costs of fuelwood from the community program. Will they be beyond the reach of the poor? By how much? How can they be brought down? Can government-subsidized fuelwood and charcoal distribution depots to distribute cheaper energy resources to the poor be established? Would this measure detrimentally affect the future capability of these people to obtain energy for domestic, agricultural, and industrial purposes? If so, should it be used only as an interim emergency measure.

- Can laws regulating firewood and charcoal prices be more effectively enforced? Would such fuelwood price regulations be detrimental or helpful to the successful initiation of the community fuelwood program? How would they affect the access of the poor to fuelwood from the project? What is the relationship between income levels and fuelwood consumption in rural and urban areas (income elasticity of demand)? What implications does this have for planning and implementing the community fuelwood program?

- Assess the needs of various income groups for fuelwood and their ability to pay or work for it. What conflicts arise between the interests and needs of the poor and landless, the wealthy, and the requirements of a successfully managed community fuelwood program? How can such conflicts be resolved or ameliorated?

6. How should the costs and benefits of community fuelwood programs be allocated to best meet the needs and aspirations of women?

In most parts of the developing world, a woman will be impacted most in terms of both costs and benefits by the initiation of a community fuelwood program. Therefore, the allocation of the costs and benefits that is likely to result from a program should be analyzed carefully and early with women clearly in mind.

Guidelines

- Evaluate the differential costs of a community fuelwood program on women. Where will such a program increase costs for women? Will it increase the time they spend on fuelwood activities? For how many years? Will it lighten or increase the "labor" spend in obtaining wood -- length and frequency of trip, weight of load, type of wood obtained, etc.? Will it decrease the status of women by relegating them to relatively less valued support tasks? By keeping them from being involved in a new and therefore "important" community program? By removing them from the fuelwood distribution chain? Will it increase actual cash costs for women? If so, where will they get the money to pay for the fuelwood?

- Determine the differential benefits for women of a community fuelwood program. How will such a program benefit women? Will it provide them with meaningful roles in an important community undertaking. Will it enable them to use their knowledge and skills regarding fuelwood? Will it decrease the time and energy they spend in obtaining wood? Will it make time available for other necessary tasks? Can it help women expand their activities into new areas such as nursery management, extension assistance, firewood sales, or community association leadership?

ANNEX 1

Footnotes

CHAPTER II: FIREWOOD

[1]Duane G. Metzger and G.E. Williams, "Some Procedures and Results in the Study of Native Categories: Tzeltal, 'Firewood'", American Anthropologist 68.2 (1966).

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[3]Bill Knowland and Carol Ulinski, Traditional Fuels: Present Data, Past Experience and Possible Strategies (Washington, USAID, September 1979), p. 2.

[4]Ibid.

[5]Erik Eckholm, Losing Ground: Environmental Stress and World Food Prospects (New York: W. W. Norton and Company, Inc. 1976), p. 103.

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ANNEX 3

TERMS OF REFERENCE

The Community Level Socio-Economic Context of Fuelwood Use

Statement of Work

1. Devres will review the existing literature, including topical publications and ethnographic monographs, to provide a world-wide picture of fuelwood use in small rural communities. The review will focus on the social, economic, ecological, national policy and other considerations that:

   a. Determine access to fuelwood producing land;

   b. Affect fuelwood harvest and distribution; and

   c. Influence fuelwood consumption, including cooking, heating, and community level manufacturing.

   Particular attention will be given to changes in (a), (b) and (c) consequent to fuelwood shortage, and to how specific communities have evolved their own programs to impose control on fuelwood usage and/or increase fuelwood supplies.

2. Devres will develop a set of guidelines incorporating the critical issues identified in the review which should be considered by the Agency in formulating energy policy and in designing, selecting, and implementing community fuelwood programs and projects.

ANNEX 4

Organizations and Individuals Contacted

The following organizations and individuals were conferred with or contacted during the course of this project to enable a broad-based examination of the issues and activities surrounding community fuelwood programs in all parts of the world. We would like to express our appreciation to all those who provided us with valuable information or directed us to other relevant fuelwood-related resources, and those who shared with us their observations and insights concerning community fuelwood programs.

Organizations

Africare Resource Center, Washington, D.C.
al Dir'iyyah Institute, Washington, D.C.
American Council of Voluntary Agencies for Foreign Service, Inc./ Technical Assistance Information Clearing House (ACVA/TAICH), New York
Baptist World Relief, Washington, DC..
CARE, Inc., New York
Catholic Relief Services, New York
Church World Service, New York
Clarke University, Worchester, Massachusetts
Commonwealth Forestry Institute, Oxford, England
Food and Agriculture Organization of the United Nations (FAO), Washington, D.C.
Georgia Institute of Technology, Atlanta, Georgia
Harvard Institute for International Development, Cambridge, Massachusetts
Hesperian Foundation, Palo Alto, California
Institute for Development Anthropology, Binghamton, New York
International Development Research Centre, Ottawa, Ontario
International Institute for Environment and Development, Washington, D.C.
International Voluntary Services, Washington, D.C.
Land Tenure Center, University of Wisconsin, Madison, Wisconsin
Library of Congress, Washington, D.C.
Lutheran World Relief, New York
Massachusetts Institute of Technology Energy Laboratory, Cambridge, Massachusetts

Mennonite Central Committee, Akron, Pennsylvania
National Academy of Sciences, Washington, D.C.
New TransCentury Foundation (NTF), Secretariat of Women and Development, Washington, D.C.
Overseas Development Council, Washington, D.C.
Oxfam, Oxford, England
Partners of the Americas, Washington, D.C.
Peace Corps, Washington, D.C.
Resources for the Future, Washington, D.C.
Rockefeller Foundation, New York
Seventh-Day Adventist World Services, Washington, D.C.
Smithsonian Institution, Washington, D.C.
SUNY/Stonybrook, Stonybrook, New York
United States Agency for International Development, Washington, D.C.
- Information Center
- Women in Development Library, Washington, D.C.
United States Department of Agriculture, Washington, D.C.
- National Agricultural Library, Washington, D.C.
United States Department of State, Washington, D.C.
University of California, Santa Barbara, California
University of London, Kings College, London, England
University of Sussex, England
University of Washington
Volunteers in Technical Assistance, Washington, D.C.
World Bank, Washington, D.C.
World Concern, Seattle, Washington
World Neighbors, Oklahoma City, Oklahoma
Worldwatch Institute, Washington, D.C.

People

Allan Alemian, Africare
J.E.M. Arnold, Forestry Department, FAO
Todd Bardlum, International Institute for Environment and Development
R.D. Barnes, Commonwealth Forestry Institute
Andrew Barnett, University of Sussex
George Belt, USAID
John Bene, IDRC
Norma Benner, New TransCentury Foundation
Jim Bever, SUNY/Stonybrook
John Blumgart, USAID
Bill Bower, Hesperian Foundation

Robert Brandt, International Forest Service, USDA
Norman Brown, USAID
Terry Bruce, World Concern
Jeffrey Burley, Commonwealth Forestry Institute
Bob Bush, Lutheran World Relief
Thomas Catterson, Forestry Department, FAO
Elizabeth Cecelski, Resources for the Future
Thomas Conelly, Department of Anthropology, UCSB
Dan Deeley, USAID
Sidney Draper, World Bank
Erik Eckholm, Department of State
Elizabeth Ernst, Peace Corps
Lawrence Ervin, al Dir'iyyah
Chris Flavin, Worldwatch Institute
Dick Fletcher, Partners of the Americas
Patrick Fleuret, USAID
David French, USAID
Carolbeth Gibbons, Library, UCSB
Blondine Gravely, Worldwatch Institute
Ken Green, Smithsonian Institution
Steve Hirsch, Volunteers in Technical Assistance
Tom Hoffman, International Institute for Environment and Development
Michael Horowitz, Institute for Development Anthropology
Marilyn Hoskins, Consultant
Jane Jacquette, USAID
Paul Jankura, Peace Corps
T. Jenner, American Council of Voluntary Agencies for Foreign Service
Amy King, International Forest Service, USDA
Steven Klein, USAID
Ulana Klymshyn, Department of Anthropology, UCSB
Harold Koslowsky, Mennonite Central Committee
Sam Kunkle, Peace Corps
Robert G. Lee, University of Washington
Robert MacAllister, USAID
Bill McGrath, Consultant
Cynthia Mackey, Natural Resource Defence Council
Kirin Magiawala, California Institute of Technology
Victor Mercado, Baptist World Relief
M.M.A. de Montalembert, Forestry Department, FAO
W.B. Morgan, Kings College, University of London
Jeanne North, USAID
Phil O'Keefe, Clark University
Bob Otto, USAID

E. Pelinck, Forestry Department, FAO
Alan Poole, USAID
Bernadette Pratt, Oxfam
Bert Printz, USAID
Bill Ramsey, Resources for the Future
David Rhoad, USAID
Ben Salom, Forestry Department, FAO
Robert Sivers, Library, UCSB
Emmy Simmons, USAID
Tom Sine, World Concern
Peter Snoad, International Voluntary Services
John Spears, World Bank
Elizabeth Stamp, Oxfam
A. Strout, MIT Energy Lab
Jim Tarrent, Overseas Development Council
Charles Taylor, Seventh-Day Adventist World Services
Greg Thomas, Natural Resource Defense Council
Hank Tiarks, World Neighbors
Nat Treadway, Volunteers in Technical Assistance
Carol Ulinski, Consultant
Bob Walsh, Catholic Relief Services
Jesse Walton, Georgia Institute of Technology
Jay Weinstein, Georgia Institute of Technology
Peter Wood, Commonwealth Forestry Institute

ANNEX 5

Research Methods

A multi-pronged approach was taken in the identification and collection of literature relevant to this study of the social and economic aspects of community fuelwood programs. The main sources were found to be ethnographies, conferences and research papers, donor agency project documents and topical literature publications. These were identified through several computer searches, review of relevant bibliographies, and library card files, discussion/research of donor agency program reports/files, and many hours of combing the shelves of individuals and organizations involved in community fuelwood and related issues. The latter activity provided access to many unpublished sources. There were also numerous conversations with people involved or interested in this field and in specific parameters of this project.

Most of the work was done out of two locations, Washington, D.C. and the University of California - Santa Barbara, which enabled the contacting of many organizations and people involved in fuelwood issues, and use of extensive library resources. There was also a rapid research trip to Rome and London, to meet with and take advantage of the resources of several institutions (the Food and Agriculture Organization of the United Nations, University of London, Kings College and the Commonwealth Forestry Institute) and individuals known to be particularly active on issues relating to community fuelwood programs.

Ethnographics

In order to tap the ethnographic monographs and articles, assumed to be one of the principal sources of information, a systematic search was made of the literature, using the following methods:

- examining/reviewing major works already aware of;
- reviewing indices of all major anthropological journals as well as many serials in related fields;
- making a shelf check in likely places in the library at University of California, Santa Barbara - though random, this method was quite fruitful; and
- examining the relevant entries in HRAF, Human Relations Area Files which proved extremely rewarding.

Conference/Research Papers, General Works

Conference papers were reviewed as they were encountered in files or as shelf documents (this proved to be a very adequate source) with the exception of those papers from the Eighth World Forestry Congress held in Jakarta, Indonesia in October, 1978, which had the very relevant theme of "Forestry for People." The entire set was reviewed at the U.S. Department of Agriculture and the most relevant ones examined in detail. Many research papers were examined, as well, found primarily in individuals' private collections.

Many relevant documents were found through consultation of bibliographies from forestry and community development related papers. Topical literature and papers put out by research groups and interested organizations contacted or identified were examined.

Project Documents

The major U.S. and international donor agencies, including AID, the World Bank, and FAO, involved in community fuelwood programs were contacted for information on their programs. They are listed in full in Annex 2. Also contacted were a number of non-profit organizations involved in community forestry activities to some degree in one or more developing countries.

Computer Search

The computer searches using the DIALOG/DATABASE produced extensive citations. Seven files were selected for computer-search review, based on the expected relevancy and coverage of the topic area.

The files selected, preceded by the number of references they yielded, were:

109-C ----- AGRICOLA (National Agricultural Library) - Citations

160 Abs --- COMMONWEALTH AGRICULTURAL BUREAUX ABSTRACTS (England)

25 Abs --- ENVIROLINE (Environment Information Center, New York) - Abstracts

6 C --- SOCIAL SCISEARCH (Institute for Scientific Information, Philadelphia)

25 Abs --- N.T.I.S. (National Technical Information Service) - Abstracts

Discarded - P.A.I.S. INTERNATIONAL - Citations Only

Discarded - S.S.I.E. (Smithsonian Science Information Exchange)
Project Description

The descriptors chosen were:

FUELWOOD	as	Title, Descriptor, Identification
FUEL(w)WOOD		
FIREWOOD		
FIRE(w)WOOD		
CHARCOAL(F)WOOD		
CHARCOAL(F)WOODLOT		
CHARCOAL(F)FOREST		

Periods covered were: Agricola, 1970-December, 1978; CAB ABS, 1972-July, 1979; Enviroline, 1971-August, 1979; Social Scisearch 1972-Week 36 1979; N.T.I.S., 1964-1979 Issue 21 (week); P.A.I.S. International 1976-July, 1979; S.S.I.E. 1975-July, 1979.

Research Trip

In addition a research trip to Rome, Italy and London and Oxford, England was taken November 3 - 14, 1979, by Beth Jackson a Devres Research Assistant. Three days were spent at the Food and Agriculture Organization of the UN in Rome, meeting with their Forestry personnel and reviewing some of their documentation. Four days were spent in England, looking through files at University of London, King's College, and at the Commonwealth Forestry Institute located in Oxford.

The trip provided access to documents which would not have been otherwise available. It also enabled the exchange of ideas concerning the future of community forestry/fuelwood programs, and as to what might be the critical constraints, and elements leading to project "success."

ANNEX 6

Descriptions of Selected Community Fuelwood Programs

1.	South Korea	p. 266
2.	India - Gujarat	p. 268
3.	India - Maharashtra	p. 270
4.	China - Integrated Village Forestry	p. 272
5.	Indonesia - Community Development, East and Central Java	p. 275
6.	Nepal - Fodder Tree System	p. 277
7.	Thailand - Forest Village System	p. 279
8.	Nigeria - Farm Forestry	p. 282
9.	Ethiopia - Forestry for Community Development	p. 283
10.	Tanzania - Village Afforestation	p. 285
11.	Columbia	p. 287

1. South Korea*

A large percentage of Korea's domestic energy is used to heat the home during the cold winters, when a family can burn as much as four tons of organic material to keep warm. Also, in a country where ancestor worship is still an important part of daily life, families reserve some forest land for burying their dead. On the supply side, all forest land was public until 1910, when private ownership was legalized. However, peasants still view this land as a public good and collect forest products freely. As a result, there has been little incentive for owners to replant and maintain this land. As wood becomes more scarce, people are turning to agricultural residues, grasses and forest litter as sources of fuel. As elsewhere, removal of ground cover is causing erosion on hillsides, downstream flooding and declines in soil fertility.

Village Forest Associations (VFAs) have sprung up spontaneously throughout Korea since the 14th Century and were formally recognized by the government in 1951. One decade later the Forest Law was enacted which provided a legal basis for VFAs, recognizing them as cooperatives responsible for implementing forestry activities. Then in 1973 the government launched the Ten Year Forestry Development Plan, and undertook a number of measures to boost the country's reforestation program. These efforts were consistent with the Saemaul or "New Community" movement, inaugurated in 1971 to slow down rural-urban migration by decentralizing economic development and enhancing the standard of life in the countryside. The forest service was reinforced; laws were passed, and are being enforced, which prohibit tampering with forests, as well as requiring forestation of all steep lands: and an extensive public education campaign was started. Perhaps most significantly, VFAs have been established in almost every village in the country to execute forestry activities.

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* Extracted from Bill Knowland and Carol Ulinski, Traditional Fuels, (Washington: AID, 1979), pp. 27-29.

VFA membership, which is mandatory, includes forest landowners and representatives from each household. Every VFA is part of the national, nongovernmental network, the Korean National Federation of Forestry Associations, based in Seoul. This union acts as a liaison between the individual VFAs and the government forestry service, the latter providing policy guidance and financial and technical assistance.

During the initial phase of the program, surveys were made in each village to calculate local needs for forestry products and identify lands suitable for reforestation. Trees are planted by the villagers on a volunteer basis. If the land to be planted is privately owned, the landowner has the choice of doing it himself or turning it over to the association. The harvests are distributed among all households. Marketable surpluses are sold and the proceeds are deposited into the village cooperative fund for use at some future time. The VFAs also patrol the national forests in their vicinity, protecting them against illegal exploitation and forest fires. In return, they are free to harvest forest products and fuelwood.

The accomplishments of the program are impressive. Korea appears to be well on its way to solving its fuelwood problem. By 1977, about 643,000 ha. of fuelwood plantations had been established.* According to Bong Won Ahn, an official of the national federation:

> The fuelwood component of our forestry program is essentially finished. We calculated the needs and set planting targets, and now these have been met. By the early eighties, when increasing amounts of wood will be harvested from the new plantations, our rural fuel problems will be largely solved.

Trademarks of the Korean program include strong government commitment to and support for a national and community forestry program, and active village participation. It should be noted, however, that participation is mandatory, although the work and the benefits are equally shared by all.

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*About 177,000 ha. of the total were financed with a loan from the World Bank.

2. India - Gujarat*

The core of social forestry in Gujarat is the village plantation scheme. Back in 1973, following the initial success of the roadside and canal-bank program, foresters began visiting villages to discuss the possible establishment of plantations on some of their communal lands. They proposed to the panchayats, the elected councils that govern each village, that they set aside a minimum of four hectares for this purpose. The department would supply seedlings and pay poorer villagers to do the preparation and planting; the villages would in turn guarantee to protect the areas from grazing and unauthorized gathering. The villages would have the right to harvest grass and fruit from the plantations free of charge. When it came time to harvest the trees, the panchayats and forest department would split the proceeds. Harvested firewood and timber would be sold through government-run depots at prices well below those of the marketplace. "When we first made these proposals the panchayats were suspicious", recalls Dalvi.

> We had to visit some villages five or six times over a year or two in order to convince them of the benefits, and to allay their fears about giving up land.

By 1978, after four years of effort, nearly 3,000 of the state's 18,000 villages had established woodlots through this program; each year more agree to enter the scheme, and many have decided to devote more than the minimum four hectares to forestry. Some have even given precious irrigation waters over to tree growing.

One reason for the village program's spreading popularity is the quick returns it generates. It is commonly thought that forestry takes too long to be attractive or feasible to poor villagers, but this notion has been disproved in Gujarat.

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* Extracted from Erik Eckholm, Planting for the Future: Forestry for Human Needs, Worldwatch Paper 26 (Washington: Worldwatch Institute, 1979), pp. 53-55.

> Most of the lands we're planting are called grazing lands, but in reality they're nothing more than exercise grounds that have scarcely produced a blade of edible grass in years,

observes Jhala. After one year of protection from livestock, grass that can be harvested by hand usually springs up on these same lands. Suddenly, the villagers are receiving economic benefits from an area that was formerly worthless. In the second year, some fruit trees begin to produce as well. And, even in the absence of irrigation, most of the tree species planted grow quickly enough to convey an obvious message to nearby residents.

> Rhetoric about improving the environment and quality of life does not make any sense to the rural folks,

S.A. Shah points out, but it does not take long for these "hard realists" to recognize real benefits materializing before their eyes.

Another potentially significant component of the state's social forestry program is just now getting under way. Large forest areas have been severely degraded by pilferage and by landless drifters who practice shifting cultivation wherever they can get away with it. Through what foresters are calling the "social security" program, landless families will be placed in charge of an area - initially 2.5 hectares - and be paid wages year-round to plant seedlings and protect them to maturity. The family will be assigned an additional area for planting each year until the first year's trees are ready for harvest ten or more years later, at which time the family will receive 20 percent of the proceeds from the sale of the timber. Thus currently rootless people will both receive a steady income and have a personal stake in the quality of the forests they tend. Efforts to establish plantations in these reserve areas have been consistently frustrated. The state is now planning an innovative measure that may at once create forest resources and provide a secure, reasonable income to those now undermining reforestation efforts.

As practiced to date, social forestry in Gujarat has led to neither the self-sustaining community involvement nor the transformation of social relations that community forestry can in theory entail. The village woodlot program is clearly an operation of the state forest service rather than a self-help scheme. The use of the panchayats as the main filters through which village opinions are

expressed and benefits are distributed is enough in itself to keep the program from rocking the socio-economic boat; the tendency for these bodies to be dominated by economic elites and political factions is legendary. As the local forestry program continues and villagers gain experience in its management, state officials say, more control may be handed over to village institutions. The existing village forestry program is unlikely in itself to upset the stratification of social classes. Still, to the extent that procedures are set up whereby new wealth is created on communal lands and is shared equitably among villagers, the absolute well-being of the poor will be improved. The proposed "social security" program, in particular, will help some landless people accumulate assets and gain more control over their lives.

Even under existing conditions, the degree of cooperation by Gujarat's villagers has been phenomenal. The best evidence of this lies in the absence of good fencing around both the roadside and village woodlots. The trenches, live cacti, or thorny shrubs now used to demarcate the forests would scarcely slow down a person intent on stealing some fodder or fuel. "These barriers are there more for psychological than for physical reasons," says one official, "and the amazing lack of stealing is an indication of the people's support for the social forestry program." The barbed wire often deemed essential by foresters working in less cooperative environments would be prohibitively expensive in India - and in most developing countries, for that matter. Its absence in Gujarat bodes well for the future of community forestry.

3. India - Maharashtra*

The afforestation project is designed to check deterioration of the land, stem destruction of any remaining forests, prevent soil erosion, preserve ground moisture, develop improved grass fodder for livestock and, in the long run, provide wood for local construction and consumption.

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* From Lutheran World Relief, "India: Afforestation in Six Villages; Maharashtra - Progess Report" (New York: Lutheran World Relief, November 21, 1978.)

The project, as originally designed, aimed to reforest a total of 238 acres in the following villages:

Pargaon	61 acres
Kolhewadi	49 acres
Ukkadgaon	10 acres
Dashmigavan	10 acres
Rattadgaon	59 acres
Jamb	49 acres

The project was to include preparation of the land for planting by construction of gully dams and contour trenches. Trees were to be raised in a nursery, planted on village plots and protected from cattle. Forestation was to be executed through a special camping program of the National Service Scheme. In this program, village youths participate in development activites and promote nation-building in rural areas.

CSRD wrote, "We are extremely happy to report that the forestation program has proved to be one of great success." The program is unique in that all the land planted with trees has been made available to the villages by individuals. That private land has been donated for the purpose of planting trees for the general good is of great significance. It indicates the people of Maharashtra's enthusiasm for promoting their own development. Though only a total of 49 acres have been planted, the trees have been well looked after, consequently the mortality rate is 1-2%. The Indian Government's forestation program adjoining that of CSRD has, in comparison, been a total failure and trees have suffered a mortality rate of 99%. Because of this sharp difference in results, the project supported by LWR has acquired demonstration value throughout the state of Maharashtra.

The trees are of several varieties, each selected to suit the soil of the particular plot. Timber and fuel trees have been planted on wasteland while fruit trees, which will yield an income of up to Rs. 6,300 per acre, have been planted on fallow, or semiwaste land. Trenches to protect the trees from cattle surround all plantations. Digging of trenches has been one of the contributions which youth from the National Service Scheme have made to the project.

Initial efforts have concentrated in two villages, Pargaon and Kolhewadi. Here land and water were already available, the community was already organized and several developmental activities were in progress.

In Pargaon, 12 acres of fruit trees have been planted and 18 acres of fuel and timber trees have been planted. In Kolhewadi, four acres of fruit trees and 10 acres of other trees have been planted. In this village, soil conservation activities have also begun.

Forestation has also commenced in Ukkadgaon and Dashmigavan, but on a much smaller scale: four and one acres respectively. Both these villages suffer from an insufficient water supply.

In Rattadgaon, a lift-irrigation project was not completed, therefore, forestation could not begin. Plans are to commence planting here, and in the remaining village of Jamb, during the coming monsoon season.

CSRD has experimented with fodder cultivation in the villages; initial results were encouraging, but the rains failed, so ultimately the experiment was not successful. It will be tried again next year. A seminar on fodder cultivation was organized at Ahmednagar, in cooperation with Action for Food Production (AFPRO) for farmers from all over Maharashtra State. The participants visited the experimental plots and also had opportunity to observe the forestation program.

Looking to the future, the CSRD's forestation program in Maharashtra aims to concentrate on expanding the existing plantations and establishing new ones in the villages of Jamb and Rattadgaon. The program will also continue experimentation with fodder cultivation and will promote soil conservation activities.

4. China - Integrated Village Forestry*

The underlying technical principle in China is rational use of land for agriculture, forestry and related activites with the object of maximizing productivity. The following systems are employed:

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* Extracted from FAO, Forestry for Local Community Development, Forestry Paper No. 7 (Rome: FAO, 1978), pp. 66-67. See also FAO, China: Forestry Support for Agriculture. FAO Forestry Paper No. 12 (Rome: FAO, 1978), and Eckholm, Planting for the Future, 1979.

- types of 'taungya plantation' with inter-row cropping of such crops as melons, cassava, groundnut, ginger and soybeans;

- raising of fodder crops and grazing under forests;

- growing of non-timber forests using food, fodder, medicinal and oil trees and other economic crops such as walnut, chestnut, fig, camphor, tea oil, tung oil and bamboo;

- 'four around' forestry, around houses, villages, along roads and waterways using such fast-growing trees as poplars, willows, pines, firs, eucalypts, and other types of vegetation such as bamboo;

- forestry farms with the primary objective of timber production, which often have subsidiary activities yielding minor products such as medicinal plants, mushrooms or basket fibres.

In all of the forest systems, state policy and wood scarcity ensures complete utilization of the forest resources as timber, pulpwood, fuel and even prunings are salvaged for fuel or compost. Multiple use is extended to forest nurseries, where pig rearing or vegetable growing is associated with raising tree seedlings (in Chanku Tai nursery, edible Chinese cabbage was grown at the edges of seedbeds).

Mass participation in forestry by communes is fundamental to local forestry. Article 3 of the Forest Regulations of 1963 states:

> Revolutionary committees at the various levels must strengthen propaganda and education in order to promote forest consciousness and forest education and mobilize the masses to properly protect forests and trees.

Most of the plantation techniques employed are labour intensive. Professional foresters and technicians provide guidance to men and women engaged in afforestation and logging. Forest research also provides a backing up service. Aspects of silvicultural management are the responsibility of 'professional teams'.

Regional forestry bureaux are directly involved in communal forestry. The regional forestry bureau of Tailin, for instance,

controls 31 production units in 11 forest farms, and a full infrastructure organization. The bureau is responsible for providing such social services as health, education, recreation and shopping facilities.

One of the 11 forest farms, of some 3,000 ha., provides employment for some 48 people, including teachers, doctors and maintenance workers. The farm facilities include housing, schooling, bath houses, clinic and a dormitory for working middle school graduates.

Integration of forestry and agriculture, which has occurred at all levels in China, has had a positive impact. A shelterbelt project, for instance, in the northwest, 1,500 km long by 12 m wide, was executed in two seasons by some 700,000 farmers from nearby communes. In Fu Kou county, from 1958 to 1975, 74 million or some 140 trees per head of population had been planted and some 10,000 ha. of windbreaks were established. Between 1970 and 1975 thinning yields in the county contributed to the construction of 80,000 housing units. In Min Chin county, 30,000 ha. of sand dune planting and shelterbelts doubled food production per unit area over a protected area of 150,000 ha. In Chouchou county extensive forestry programmes, including planting 16 million trees in 'four around' systems, were closely associated with the doubling of agricultural yields over a ten-year period.

Key Factors

- The complete integration of forestry with agriculture in the broadest sense;

- The ability to motivate the people and develop a strong national and communal commitment to create and conserve forests as part of an integrated agricultural programme;

- The commitment of the State to forest and agricultural development;

- That despite initial disappointing plantation results, the motivation and enthusiasm of the people is such that, employing improved techniques, they were able to continue developing planting programmes without any major check.

5. Indonesia - Community Development Programme in the State Forest of East and Central Java*

The forest area covering almost 2 million ha. in East and Central Java is managed by the State Forest Corporation, Perum Perhutani. The forests are mainly planted with teak which covers some 845,000 ha. The area enjoys an extensive infrastructure. An important feature of the area is a population density of 570 persons/km^2, which puts some pressure on land and the forest areas. One of the aims of Perhutani is to improve the life of people in the vicinity of the forest in an effort to reduce demands on forest land. The families are close knit and there is significant social ranking and a particular respect for elders. Whole family units assist in harvesting agricultural crops. Perhutani employs an extensive labour force. The planned programme to improve community life is mainly directed at increased production through agrisilvicultural systems. The main system is 'tumpangsari' (taungya) combining food production and planting of forest trees, mainly teak. A further system involves raising grass fodder under teak, with the fodder used for a zero grazing cattle fattening programme. Other projects involve the growing of red kaliandra (Calliandra calothyrsus) fuelwood belts, to provide firewood for industry and communities. Pilot projects in beekeeping and sericulture have also been introduced recently.

The main objectives are firstly conservation of the forest resources and secondly raising the standard of living of the local community by increasing food production from forest land by using agrisilvicultural systems. This latter objective aims at having an annual programme of 50,000 ha. of taungya plantation by 1978/79, as well as establishing 10,000 ha. by other plantation methods.

The main tree species is teak planted at 3 x 1 m, and the silviculture of this tree is well known and techniques are well established. The 'taungya' system which is restricted to comparatively fertile flat or gently sloping sites is also well established, but improved agricultural crop varieties and fertilizers have increased yields threefold. The fertilizer applications also appear to have increased teak growth rates.

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* Extracted from FAO Forestry - Community Development, 1978, pp. 74-75. See also Soekiman Atmosoedaryo, "Community Development Programme in the Forests of Central and East Java, Indonesia" FO: MISC/77 (Rome: FAO, 1977).

In 1973, Perhutani began investigating the productivity of elephant grass, Pennisetum purpureum, under teak, mahogany and pine plantations in the forest area. The grass is being sold to farmers and no cattle are allowed to graze in the forest.

The Pennisetum fodder grass is productive for 4/5 years and can be cut 10 - 11 times per year if irrigated, giving up to 150 t wet grass/ha/yr and up to 75 t rainfed. Average yields of 60 t/ha/yr are expected.

All activities are controlled, organized and take place on state-owned forest land managed by Perhutani, which provides a number of inputs:

- loans for fertilizers or cattle,
- improved non-teak wooden housing in temporary (5-6 year) forest camps with the houses being dismantled and given to labourers after 6 years,
- social inputs including health facilities,
- training and extension for forest workers and farmers.

The participants in the schemes contribute their labour and in return enjoy increased incomes from cropping and fodder and the payment of an incentive bonus after 2 years.

Loans and extension allow the development of improved agricultural methods.

Most of the projects are at early stages and achievements are slight at this stage. Some 5,000 ha. are under intensive taungya cultivation with application of fertilizers, superior seeds, etc., and a rapid rate of development is projected. For grass fodder 881 ha. were established by 1976 as were 733 ha. of red kaliandra fuelwood. There is a waiting list of people eager to participate in these projects.

Key Factors

- The main factor is land hunger which allows the extensive development of 'taungya' plantation systems.

- The recognition by the forest authority of the need for public and local relations, by the promotion of a number of projects which will benefit local communities.

- The forest estate has been established for a considerable period, and consequently forest management takes precedence over other factors.

- Inputs and benefits require some quantification to determine the relative return on inputs to the community and forest agency.

6. Nepal - Fodder Tree System in an Integrated Rural Development Project *

Some 60 percent of the population of Nepal lives in the hills, 30 percent in the Terai and 10 percent in the Himalayas. The national density average is 620/km^2 of cultivated land rising to 1,100/km^2 in the hills. Estimated per caput GNP is US$90-100 and Nepal is classed as one of the least develped nations.

Agricultural development strategy seeks to balance economic growth with income distribution and provide more equitable regional development. It proposes to correct declining agricultural productivity, and control spontaneous settlement in lowland forests by large numbers of marginal farmers from the hills.

The full rural development projects aims at intensive agricultural extension, improving crop yields, farmer and staff training, livestock development, improving marketing, improved land use and control of soil erosion, provision of small warehouses and credit, providing health centres and developing village water supplies, reforestation, providing tracks and bridges and improving cottage industries.

Forestry is part of a wide restructuring of the rural economy which makes it possible to reduce cropping and grazing pressures on land that should be regenerated or replanted to forest cover.

The forestry components of the project are:

- reafforestation for fuel and fodder on government land,
- regeneration and protection of forest areas,
- forest erosion control.

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* Extracted from FAO, Forestry - Community Development, 1978, pp. 77-79.

The total forestry programme covers some 8,600 ha. over an initial five-year period and all of the functions are interrelated. Fuel and fodder plantations total 2,100 ha., but of this 25 ha. blocks of fodder plantation will be sited in each village Panchayat area. Some 6,000 ha. of degraded forest would be regenerated by the provision of fencing and guards whilst 470 ha. of planting would be sited on bare erosion sites. The forestry programme is to be preceded by a first year survey to determine precise areas for development. All of the forestry programme has a protective function, but apart from the areas designated for specific local production, the protection forests are also expected to yield fuelwood and, more importantly, fodder. There is a large livestock population which, as has been already noted, is highly prized by the village communities and, as a consequence, fodder is a most important forest product.

In Nepal, local development programmes are planned and implemented by institutions set up under the Panchayat system which is a structurally integrated four-tier system of administration. Legislation introducing the system was enacted in 1962 and the first election of office bearers was held in 1963. The four levels of this local government system are elected Village Panchayats, District Panchayats, Zonal Panchayats and the National Panchayat. The main aims of the system are to secure grass root level participation in local development and welfare schemes, to make higher levels of government administration responsive to the needs of the people, and to decentralize administration to utilize more fully local resources of men and materials.

To attempt to secure the required level of cooperation and coordination between district Panchayats and technical ministries, they have been put into a secretariat under the control of Chief District Officer (CDO) for local development at district level. The CDO's function will be to promote the smooth implementation of district development plans and he is also responsible for law and order. When a plan has been approved, the individual components are implemented under the direct supervision of the technical functionnaires of the concerned ministries, but under the overall guidance of the CDO with the support and cooperation of the District Panchayat.

The Nepalese Government has recognized the need for community involvement in forestry. The recent 1976 policy provides for the vesting of responsibility in the local community for small woodland areas in agricultural zones together with rights to produce from these areas. Forestry development will be carried out by the forest department with the cooperation of District and Village Panchayats.

Key Factors

As this analysis is based mainly on a pre-project appraisal, the identification of key factors must be conceptual rather than actual.

- That forestry as part of an integrated rural development programme could contribute to raising the standard of nutrition of the local community from below subsistence level.

- Realisation of the importance of forestry, to the extent of transferring cultivated land to forestry by increasing agricultural yields using improved methods on the remaining farmlands.

- The recognition that not only community production forests but local protection forests should make some contribution to local needs, provided the main protection function is attained.

- In an area of high livestock population, the established importance of the forests as a valuable source of fodder for supplementary feeding.

- Directing rural development strategy, including that of forestry, through the Panchayat (local government) system so that both planning and implementation are discussed and approved at the village level.

- The recognition that technical weakness in the Panchayat at district level requires to be made good by Government and external technical inputs and training.

7. Thailand - Forest Village System*

Destruction of forests by shifting cultivation is a serious problem in Thailand, particulary in the northern and northeastern regions. The evolution of a Forest Village System is an attempt to relate the work of forestry and public welfare, to promote rural development, reforestation and sound land-use.

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* Extracted from FAO Forestry - Community Development, 1978, pp. 85-86.

The objectives of the forest village scheme are: a) to attract landless people to establish themselves in forest villages, which offer improved facilities, a better standard of life and greater stability than nomadic life; b) to encourage village people to establish 'taungya plantations' to reforest areas of the forest estate which have been degraded by over-exploitation or shifting cultivation; c) to create, in so doing, opportunities for long-term forest employment.

A forest village comprises approximately 100 families and each family unit is allotted 1.6 ha. per annum, for clearing and taungya cultivation for 3 years. The scheme and the village programme is supervised by an officer for the Forest Industries Organization (FIO). Other inputs by the Government include the land, tools, social services and infrastructure and a cash bonus of up to US$ 155 per year for a good performance. Besides this cash bonus the forest villagers get some income, which may be up to US$ 500 per year, for the agricultural crops they grow between the forest trees. The programme is assisted by an extension service.

Progress with the forest village scheme, which commenced in 1968, has been gradual, and at no time was it anticipated that there would be rapid development. Taking Mae Moh village as an example, involvement was gradual with 31 families joining during the first four years, 55 families in year five, and 14 families bringing the number up to the planned total of 100 in year six. During this development and settling-in stage it was not possible to meet the annual target of 160 ha. of taungya plantation without hiring outside labour to make up area deficiencies. By 1973, the Forest Village System was achieving some 2,000 ha. of taungya plantation per year which is well short of the possible rate of 32,000 ha/year, but is a useful beginning.

In 1976, the whole reforestation programme of FIO had some 30 units and trees were planted on an area of 10,600 ha. There were 21 forest villages with 817 families and 4,325 persons. FIO provided 11 permanent primary schools for 886 pupils.

In 1977, 35 units of reforestation were under FIO control. These units are expected to increase to 40 in 1978. The projection is that 5 units will be added every year up to 1980.

(One unit of the FIO reforestation programme is a working group for reforestation of 160 ha/yr over the whole area of the rotation of a specific species such as teak. The whole area of a unit for teak would be set at 9,600 ha. for a 60-year rotation, and for Parkia spp, at 4,800 ha. for a 30-year rotation, etc.).

Key Factors

- The absorption of shifting cultivators into permanent forest village communities by providing incentives which should improve their standard of living, at the same time providing cash incentives for the development of 'taungya plantations' with prospects for long-term employment in forestry.

- The relating of forest village planning to Hill Tribe Welfare Studies which determine, in depth, the needs and possibilities of the local people.

- Teak, the main species planted, is indigenous to Thailand and its silviculture is well defined.

- Adverse features include low income and periodic distributions of cash flow causing financial hardship to participants, transport problems as taungya areas become more distant from the village, and the unsatisfied aspirations of the participants to have a permanent farm area of their own. Attempts are being made to eliminate adverse factors through the establishment of resettlement villages of 200 - 500 family units, provision of 2.4 ha. leases for permanent farming and long-term loans to assist house construction costs and initial farming investments. These recommendations take care of the main adverse factors noted, but the provision of farmland creates some conflict between the farm and the taungya plantation for the available cultivators' input.

8. Nigeria - Farm Forestry*

The problems in three different locations which typified the differences in ecological zonation, peoples and objectives of farm forestry were described in general. The term 'farm forestry' was used to mean the raising of forest and fruit trees in private and community lands outside forest reserves. Such trees and wood were owned and managed by the farmer or community, with or without technical, financial or other assistance from Government or non-government agencies but preferably with such assistance. Farm forestry could be practised on farmlands, compounds and unused tracts of community land. Forestry played a further important role in rural development in Nigeria through many other programmes within forest reserves such as taungya, shelterbelts, pulpwood and other plantations and through traditional employment generating activities of exploitation and regeneration.

Three examples where farm forestry was started are cited:

a) Shelterbelt project in Northern Nigeria - This is an area with urgent need of environmental improvement with a low annual rainfall averaging 700 mm. Earlier attempts at establishing some form of shelterbelts had met with mixed success. Seedlings of fruit trees had been distributed free to all interested persons and organizations. By 1976 over 760,000 seedlings had been planted. There was a certain preference for fruit trees since they had dual advantages and were traditionally protected in farmlands by rural communities.

b) Soil erosion control in Eastern Nigeria - This is an area short of wood with a serious erosion problem. The Forestry Services of the two states had been establishing forest plantations through agrisilvicultural methods, whilst recently seedlings of mainly fruit trees had been produced and sold at reduced prices.

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* Extracted from FAO, Forestry - Community Development, pp. 79-80. See also D.E. Iyamabo, B.S.K. Onweluzo and P.E. Okorie, "Farm Forestry in Nigeria," paper for Second Expert Consultation on Forestry for Community Development, June 1977 (Rome: FAO, 1977).

c) Rural forestry development project in Western Nigeria - Here, there is a high demand for wood both for domestic and for industrial purposes. The State Forestry Service, in cooperation with the Federal Department of Forestry, was involved in a campaign to encourage rural inhabitants to grow Gmelina arborea and teak for fuelwood, timber, transmission poles and as raw material for a pulp and paper mill. As in the shelterbelt project, seedlings were given free of charge to farmers. Within its first year of operations, 1976, about 700 ha. had been planted and over 700,000 tree seedlings had been distributed. In this particular area much initiative had come from the local communities themselves, and the Forest Department concentrated its efforts mainly on extension and public information. The Ministry of Information had helped to disseminate information on the project through television and radio.

It was noted that the availability of markets in nearby large urban areas and wood requiring industries had created particular conditions favourable to farm forestry. Although the primary use of the wood product would be for the farmer himself, any excess to his own needs could easily be sold outside the community thereby providing an additional income.

The need for cooperation between the various ministries involved was recommended. Since this is a forestry project, the centre of activities would be the Forestry Service. However, as resources would have to be developed within the community, inputs by other government organizations would be necessary. The Forestry Service would have an executive role and a coordinating committee of people representing other branches would be established to review periodically the progress made.

9. Ethiopia - Forestry for Community Development in Tiro*

The Tiro Subworeda comprises a mountainous valley with a population of 15,000. The people are mainly Oromo who have been sedentary agriculturists in the area since the nineteenth century.

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* Extracted from FAO, Forestry - Community Development, p. 70. See also G.M. Zeray Araya and Bo Ohlsson, "Forestry for Community Development in Tiro, Ethiopia," paper for Second Expert Consultation on Forestry for Community Development, June 1977, (Rome: FAO, 1977).

Deforestation is prevalent, but Tiro Forest of 5,000 ha. of mainly Juniperus procera and Podocarpus gracilis remains. A 50 km all-weather road has been constructed to allow logging of this forest. The road has had some community inputs and is associated with the forestry project. There are local shortages of fuelwood and poles, but it is considered that the situation will continue to worsen over the years.

Prior to the 1974 revolution there were extensive farm owner occupiers, but since then all land is vested in the state. Many of the former owned cattle, sheep and goats. The land-use pattern in the valley has not been studied. The main aspirations of the people are reported to be for clinics, schools and employment. The objectives are:

- to initiate and encourage sustained self-reliance in forestry within the context of rural development;
- to test and evaluate a methodology for rural development in Ethiopia.

Land-use and wood-use surveys are preliminary requirements. It is envisaged that 5 - 40 ha. blocks will be available on steep slopes; 1 - 5 ha. blocks will constitute minor areas, and 0.1 - 1.5 ha. areas around dwellings. As only an initial 1 ha. is planned for development, no technical details are given.

The State Forest Development Agency (FWDA) provides the main management and technical inputs. Within the project area there are 14 Peasant Associations (PAs) who select a representative committee. All land is nationalized but the people have rights of utilization. The PAs control land and labour. Forests over 80 ha. in area are state forests controlled by the FWDA; forests of less than 80 ha. are generally classified as for the community and are controlled by the PA. The project is carrying out social studies to understand the local population's attitude to forestry.

The PA contributes land, labour and community organization. The FWDA contributes technology, seedlings, training, transportation and tools. All of the material benefits are intended to accrue to the community and the state benefits from environmental effects.

10. Tanzania - Village Afforestation, Dodoma District*

Community forestry is part of the 'Ujamaa process', wherein the state wishes to mobilize all resources towards the elimination of poverty, ignorance and disease. The basic unit is the 'Ujamaa Village' and forest policy requires the encouragement and assistance of forestry by local and village organizations. Dodoma District contains some 120 villages with some 500 families in each. The people are mainly farmers and per caput income is T.sh. 34 - 45 per annum. There is an average per caput holding of five head of cattle, and this creates considerable pressure for grazing land. Community plantations commenced in 1967, but have been placed on a sounder planned basis since 1973. Fuel and other forest needs are taken from an ever-diminishing natural savanna forest.

The primary objective is to establish local woodlots for fuel and poles for local needs. Other aims include tree planting for soil and water conservation, and to reclaim depleted land.

A preliminary general soil survey was carried out. Some eight tree species are used including Cassia, Eucalyptus, Grevillea, and neem, with eucalypts being the main woodlot trees. Eucalypts are grown on a ten-year rotation with a m.a.i. of 12 m^3/ha. Plants are raised in departmental nurseries in polythene pots. The seedlings are transported to villages and villagers carry out planting and tending with technical advice from the Forest Department. Tending has proved a constraint in particular areas.

The project comes under the dual control of the District Commissioner or Party District Secretary who is a political appointee and the District Development Director who is a civil servant. All of the land is state owned. The Forest Department provides technical advice, extension, nurseries and transport for plants. Villagers are trained in forestry practices but no financial incentives are paid. The forestry staff of one professional, two foresters and nineteen others is insufficient for the required programme. The scheme also involves the Ministries of Agriculture, Land and Education.

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* Extracted from FAO Forestry - Community Development, 1978, pp. 83-84.

The community provides labour and the Government provides land, technical services and extension. The main community benefits are:

- fuel and poles,
- increased agricultural production due to reduced erosion and from time saved by not having to travel distances for fuelwood,
- income from sale of surplus products,
- technical knowledge of forestry.

Some 650 ha. of plantations were established between 1972 and 1976, and this represents approximately 40 percent of targets. Some of the plantations are already producing and meeting needs. Some areas have been lost due to insufficient tending, fire or grazing.

Key Factors

- Government's sustained commitment to raise the rural standard of living.
- Need for integrated approach to land use to reduce the conflict between agriculture and forestry.
- The 'Ujamaa process' has replaced the traditional system with a new 'non-tribal' approach, but the development of local forestry appears to require greater extension or incentives to encourage participation.
- The technical requirements for the local woodlots require to be more clearly defined and the number of species is perhaps greater than necessary.
- Community inputs and benefits have not been quantified so it is difficult to convince people that their labours will be adequately rewarded. Failed plots must have an adverse effect on participation.

11. Colombia - Forestry for Local Community Development*

Examples of community participation in the management of forest areas include:

An integrated project for development of community forestry (PRIBOCO), which was initiated in 1976, is based on a tradition of communal work and has a recognized legal base. PRIBOCO attempts to link rural communities with the conservation and development of forestry, wildlife and fishery resources. INDERENA provides technical services and physical inputs with the following main objectives: (i) increasing family income by employment; (ii) reducing agricultural pressure on forest reserves; (iii) integrated management of resources, with particular attention being paid to marginal areas. Programmes are implemented through communities to whom INDERENA pays a planting and maintenance subsidy. In relation to forestry, community inputs are labour, tools and land whilst the agency contributes nurseries, seedlings, technical assistance, incentive payments and work supervision. Funds resulting from harvesting are evenly shared between the community and the agency. INDERENA cash is funded to continue further programmes. Projects are selected on the basis of those having the soundest physical and social possibilities for implementation, and a number are sited in areas where forests are being destroyed by agricultural activities.

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* Extracted from FAO, Forestry - Community Development. 1978, p.68: see also Armando Samper, Arturo Delgado, Darfo Vallejo, "Forests for Local Community Development, Case of Colombia," prepared for Second Expert Consultation on Forestry for Community Development, June 1977 (Rome: FAO, 1977).

ANNEX 7

Additional Notes On Social Organization

Numerous points need to be borne in mind when constructing "community" woodlots or fuelwood plantations.

1. The amount of community disorganization and division

   - Resulting from social and economic differentiation among community members, based on possession or access to land, livestock, capital and credit, public resources, and so on.

   - Resulting from traditional social hierarchies, e.g., traditional political offices, castes, ethnic differences. These are often related to economic differentiation.

Disorganization and differentiation can influence the potential participation of, and distribution of benefits from, any fuelwood program. In some areas any attempt at rural development organization based on the presumption of a "community of interests" is bound to fail.

2. The necessity of incentives for maintaining the relatively long-term participation required for such programs

   - With regards to the poorest sectors, concrete and specific steps must be taken to ensure the security of their participation during and after the program. This includes protection from eviction or unemployment, and some degree of protection in marketing. Land redistribution or vertically integrated marketing cooperatives could be components of fuelwood programs.

   - With regards to women, steps should be taken to ensure that they will benefit fully from programs, e.g., local inheritance, divorce and child maintenance practices must be taken into account.

   - Local and small-scale entrepreneurs should be encouraged to participate, and market incentives, such as guaranteed prices or subsidies should be considered. Depending on local laws, if any, security of tenure must be ensured. However, the distribution of land and other resources should be aimed to achieve the widest spread of opportunity in the community.

The "target population," then, is marked by variation in wealth, income, access to public officials and services, state of health, capacity to cope with crises, support systems available, entrepreneurial initiative, and many other factors. What sort of program can be devised for one of the many rootless, ethnically varied, poor peri-urban groups that exist near all major Third World cities?

3. Combatting negative community stereotypes

As well as the rather neutral views of community presented above, there is another, much less flattering, set of stereotypes. Some persons engaged in rural development--and this often applies quite as much to nationals of developing countries as to foreigners--see rural "communities" as

backward,
conservative,
suspicious,
fatalistic,
superstitious,
at the mercy of "witch doctors,"
unimaginative,
"trapped by outmoded custom,"

and generally forming what one European development expert called "The People Problem."

Such perceptions are sometimes explicitly stated, more often implicit in statements and writings of the experts. Where there have been intensive, detailed, systematic and insightful studies made of rural peoples there has been ample evidence in most cases that the people are characterized by a quite contrary set of attributes, in that they have evolved highly adaptive and often quite complex strategies of risk-aversion and of coping with disasters. This applies to agriculturalists, pastoralists and fishing people. Rather than blindly following custom, most make a series of rational decisions which are often--given their technology and physical environment--the optimum decisions. Sometimes--and this is often seen in examples of the firewood crisis--people are forced by immediate, urgent needs to engage in actions that are socially and environmentally destructive in the long run. But to be dictated by short-term needs and to ignore long-term consideration is a common characteristic of human societies.

ANNEX 8

Possible Future Activities

1. Country Studies

This review of the literature concerning the socio-economic aspects of community fuelwood use patterns found substantial gaps in the recorded knowledge of what actually goes on in a location specific context. Also, the relevant data is scattered and often relatively dated, as much of the ethnographic data is pre-1960. Since much of the data cited in this study was collected, rapid changes have been taking place in growth, harvest, and consumption patterns in rural areas due to increasing fuelwood supply shortages, rural-urban spread and the interaction of traditional and modern forces (i.e., wood as free good versus cost commodity). An additional effort could be justified to determine the effect of these changes on the rural population and their traditional fuelwood practices based on actual field work and aimed specifically at how donor assistance could be more useful in meeting community fuelwood needs. This is particularly true if such an effort was careful to note the details of practices and programs so often missing from the current body of knowledge available to most planners--e.g., how is firewood actually allocated in a community fuelwood program? What tasks do women do? What secondary benefits do village people acknowledge as being important? etc.

Several countries should be selected for detailed studies of a community fuelwood situation and a traditional village situation. Each location should be selected as being representative in terms of degree of fuelwood crisis, concern of national government, previous studies, size, relative wealth, and relative dependence on traditional fuels (wood, crop residues, dung). The studies should be conducted over a reasonable time period by someone already familiar with the area, either a national or an American volunteer or resident (graduate student) rather than short-term "experts."

2. International Clearing House on Fuelwood

It is important to coordinate efforts in the development of fuelwood programs between international assistance agencies, nonprofit organizations and the countries themselves. An international clearing house for information on fuelwood problems and programs in developing countries would be a first step in this direction.

FAO forestry officials in Rome expressed their similar concern over this need and their willingness to serve as coordinator of such an effort. ICRAF (International Council for Research in Agroforestry) in Nairobi is establishing an Agroforestry Documentation Center focused specifically on agroforestry and tree components of development activities. This could be taken advantage of in beginning work toward an international clearinghouse.

3. Charcoal Programs

The demand for charcoal is expected to skyrocket in many developing countries because of fossil fuel price increases and the problems of not always being able to obtain fossil fuel supplies. Unlike many solar, wind and water applications, charcoal production technologies are available and can be put into use virtually overnight. As demand for charcoal grows, rural communities will respond by producing more charcoal from whatever wood resources are at their disposal. Moreover, newer charcoal production technologies are already being used, and others are being developed. For example, the new portable steel kiln developed by the Tropical Products Institute in London is being used extensively in Guyana and will soon be in operation in a major charcoal production project in Sri Lanka. Thus, charcoal production can potentially surge forward rapidly to meet energy demand requirements of many countries without requiring foreign exchange as is expected, for example, in Ghana.

The consequences of such supply responses will be paid for by rural communities in terms of deforestation, environmental degradation, a drain of their natural resources to urban areas, and in rural-urban conflict; such consequences will surely be significant in economic, political and environmental terms.

A study should be carried out to examine various rural charcoal production efforts in developing countries with three objectives in mind; namely to:

- Identify and analyze the key socio-economic elements involved in designing and implementing appropriate rural community charcoal production efforts, especially those aimed at providing charcoal for urban consumers.

- Determine the best technology for such community charcoal production efforts commensurate with capital cost, efficiency, safety, quality of product required, etc.

- o Identify the elements of rural community charcoal production operations most supportive of short and long term environmental quality maintenance.

- o Develop a guide for designing and implementing appropriate rural community charcoal production efforts. The guide could be provided to all USAID missions to help in dealing with increased emphasis on charcoal production in rural communities.

4. Economic Strategy for Community Fuelwood Program

The literature provides very little information about the economics of community fuelwood programs, past or prospective. What data is available suggests that such programs are cost effective in a micro sense, at least as compared to large scale forestry plantations. There is, however, a need to verify such micro-economic information on a broader scale; there is need to examine the broader economic issues as well. Consideration needs to be given to 1) economics of the special resource requirements (scarce extension or research talent, etc.); 2) the opportunity cost of resources used in community fuelwood programs; and 3) the costs of producing fuelwood at the community level compared to both the benefits and the need and costs of developing any other additional energy sources to supplement or displace such programs. Answers to these and related issues should enable the overall economics of such programs to be much better understood.

A first step study could be framed to review two or three existing community fuelwood programs with the following issues in mind:

- o What are the unit energy costs and benefits of the program for individual participants, the community, and the government?

- o How much of the community's total energy requirement could the program meet before costs exceeded benefits for each of the three categories above? Before unit energy costs exceeded those of other available forms of energy?

Special attention could be given to equity and distribution considerations as a part of the study.

The results should help answer questions about the effectiveness of such programs as energy providers in the longer term and in areas

where wood is still free, but growing scarce; in areas such as those near urban areas where alternative fuels might be available or from which excess demand for wood resources might be present; in communities where fuelwood requirements are larger, but land and other resources are needed for other uses, etc. Put simply, the results would help determine the extent to which community fuelwood programs can be depended upon to provide enough energy for a rural community's needs at reasonable prices and whether or not villagers and policy makers should be looking to other energy sources to meet those needs as well. It would also highlight the potential economic value of conservation applied to fuelwood consumption through community fuelwood programs.

5. Energy Ladder

There are conflicting reports in the literature as to whether people move up or down the energy ladder when faced with fuelwood scarcity. The answer to this question is particularly significant in terms of overall energy policy and for those designing energy programs or projects. Therefore, a review of selected fuelwood scarcity situations should be made to determine exactly what alternative energy sources are used, by whom, and why when such scarcity occurs.

6. Women in Fuelwood Programs

The literature indicates that women have played only a minor role in designing and managing community fuelwood programs to date. A review of operational and planned community fuelwood programs to determine the role women are playing or will play in them is needed, followed up with suggestions as to how AID and others can assure that women play their optimum role in such programs.